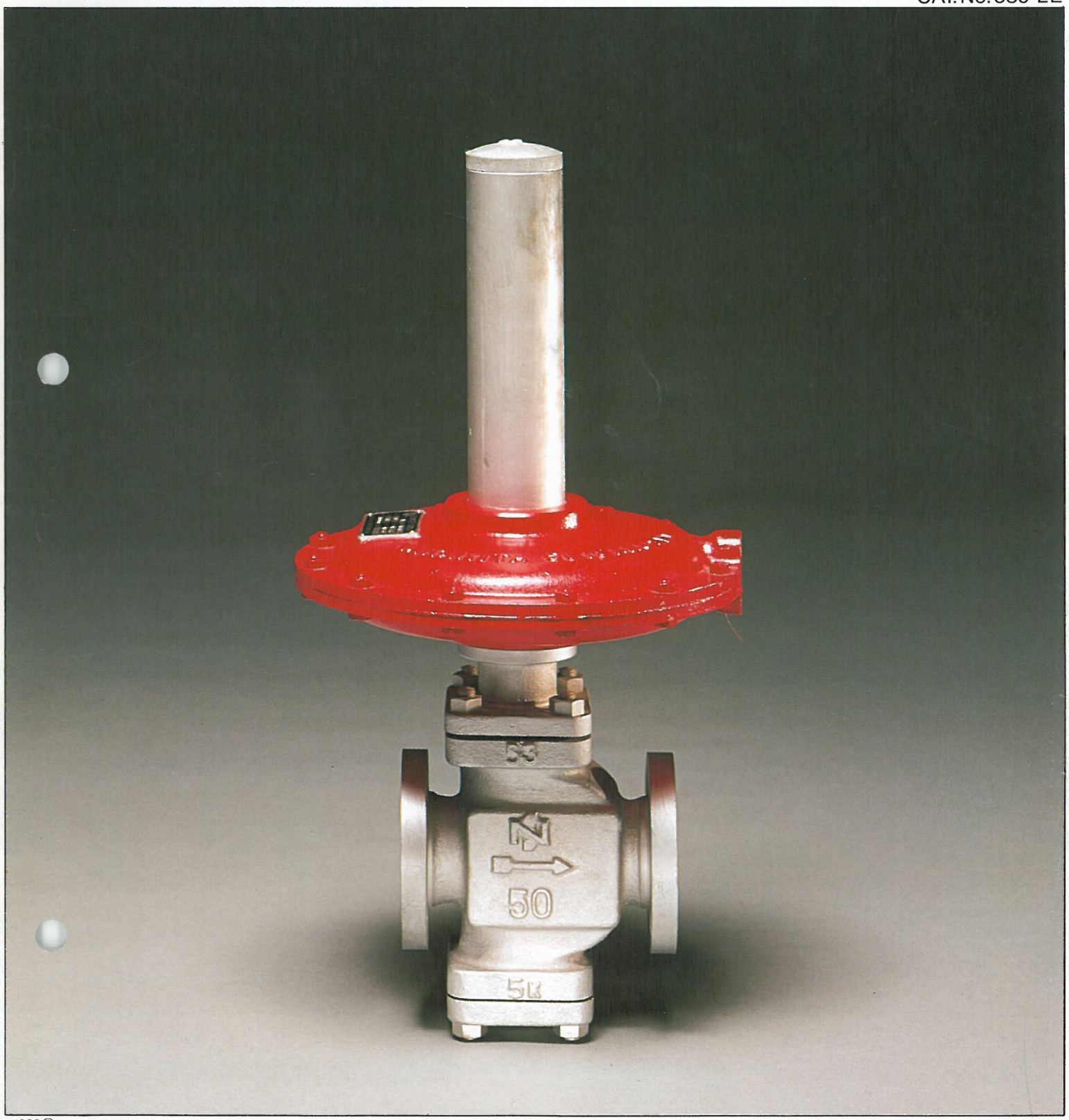
NAKAKITA

NAKAKITA PRESSURE REGULATORS

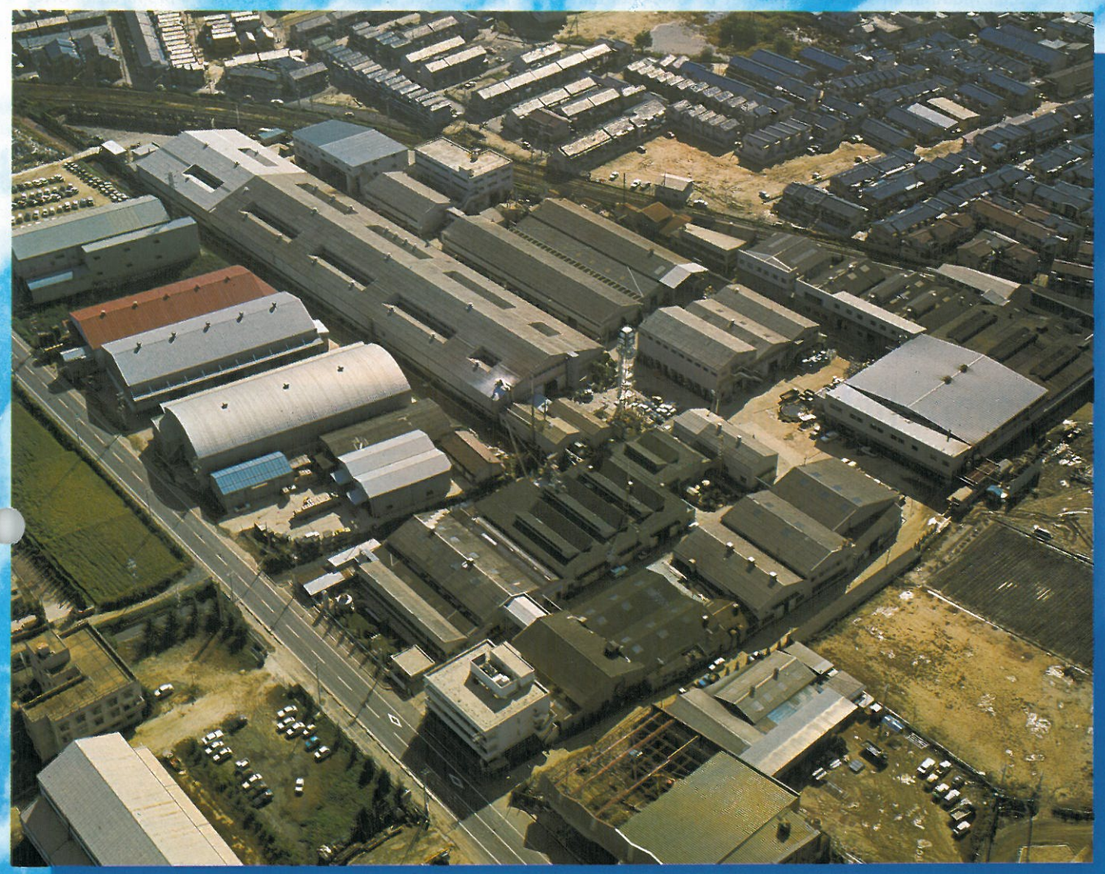
CAT. No. 530-2E



1982Ⓐ

NAKAKITA Regulators contribute to society as Bearers of Main and Local Conrol of All Industrial Facilities, with a Record of Actual Delivery of 250,000 Units.

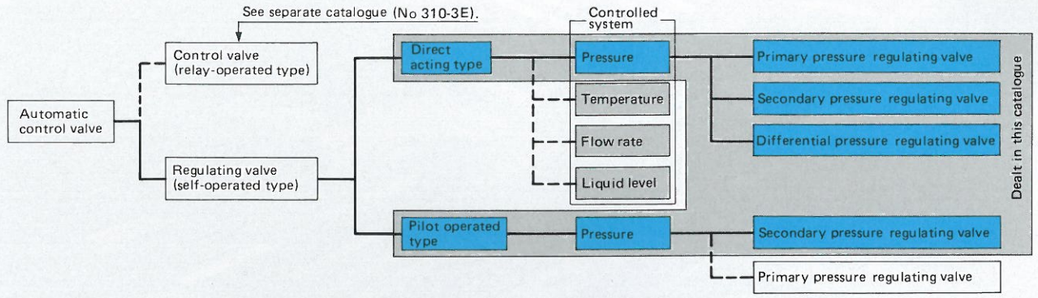
- All industrial facilities have been developing with increasingly significant tendencies towards automation and labor saving up to present.
- With the technological innovations of the industry developing, through large scale installation and automation, towards extra-large scale installation and ultra-automation, NAKAKITA, a pioneer manufacturer of automatic control valves, has been constant in developing new techniques and furthering the quality of products. With the design and manufacturing processes placed under our total quality control system (TQC), we produce a variety of valves and their systems to meet all the requirements of every customer.
- NAKAKITA, a comprehensive manufacturer of valves and their systems, has developed high-performance regulators (self-actuated type automatic control valves) of stable quality, on the basis of its resourceful experience and the record of delivery of 250,000 units in the field of regulators.
- The groups of regulators introduced in this catalogue are our standard products of NAKAKITA's standard specifications. In addition to them, we have been producing reliable, easy-maintenance and high-performance exclusive or special regulators made to the specifications of each individual customer, such as those for low pressure and high pressure combustors, lubricating oil and fuel oil devices for turbines, water sealing units, combustion gas generators, oxygen generators, nuclear power, thermal power generation, and LNG. We are fully determined to contribute further to the rationalization of the industry.



Contents

On Regulators

- In general usage, automatic control tends to imply relay-operated control system. Self-operated control system, however, may be sufficient in many cases of applications, depending on requirements in terms of the nature of the process, installation site and performance. In 1970, pressure regulator (self-operated pressure control valve) was designated as "pressure regulating valve" in the valve terminology of the Japanese Industrial Standards (JIS). Regulating valve is a generic term of control valves which do not use any auxiliary power sources such as air and electricity, and which directly receive the required power from the controlled system, through the pressure detecting means to actuate the valve.
- NAKAKITA pressure regulating valves (referred to as regulators in this catalogue) have features of economy in equipment costs, simpleconstruction, and ease in maintenance, and the record of actual delivery of 250,000 units assures their reliability.
- NAKAKITA regulators can be classified into those of direct acting type wherein the detecting means serves as the actuating means to operate the valve plug, and those of pilot operated type wherein a pilot mechanism is provided to give a high output. In selecting a regulator type, it is economical to select one according to the size of process load fluctuation.
- If your special requirements can not be met by those contained in this catalogue, please contact us. We are prepared to offer you products realizing useful ideas.



On Pressure Detecting Means

- It is not an exaggeration to say that the quality of "pressure detecting means" (namely, actuating means) determines the control accuracy of the regulators. Accordingly, we exercise special and strict care in selecting a detecting element which adequately meets your specifications. For the outline of the detecting elements, see the tables below.
- The service life of bellows, or its durability, is determined by the fluid pressure and temperature, and the quantity of expansion and contraction of bellows itself. Using the standard life cycle of 100,000 times for bellows, we have been conducting repeated fundamental researches on bellows to determine temperature, pressure and the contraction and expansion of bellows, and in turn to supply stable products of high reliability.

Diaphragm

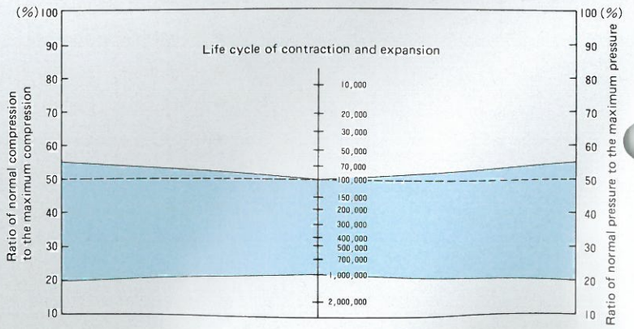
Diaphragm material	Characteristics	Standard range of application	
		Normal maximum temperature (°C)	Main fluids
NBR (nitrile rubber)	Oil resistance, and wear resistance	80	Lubricating oil, fuel oil, animal and vegetable oils, water, air, and LPG
CR (Neoprene)	Oil resistance, and weatherability	80	Ammonia gas, other atmosphere gases, and air
FPM (fluorine rubber)	Acid resistance, heat resistance and solvent resistance	150	Oxygen (ordinary temperature), oil, each gas of high temperature
C5191 (phosphor bronze sheet)	Ductility	220	Steam, and non-corrosive fluids
SUSP (stainless steel sheet)	Heat resistance, and corrosion resistance	400	Steam, and corrosive fluids
NCUB (monel metal)	Heat resistance, and corrosion resistance	450	Steam

Bellows

Type	Material	Normal max. temperature (°C)	Pressure resistance (kgf/cm²)
Hydraulic forming type	C5191 (phosphor bronze)	175	8 and under, and 15 and under
	SUS316L (stainless steel)	280	8 and under, and 15 and under
Welding type	SUS316L (stainless steel)	400	20 and under

Durability of Bellows

Find the ratios (%) of bellows compression and pressure in use to the maximum values, respectively. Connect the points on both scales, which correspond to the ratios respectively, with a straight line. The point at which the straight line intersects the central scale indicates the service life of the bellows.



■ Hydraulic forming type bellows are selected for services within the range colored in blue.

Kinds of Regulators

■ These tables indicate specifications of our standard products. We produce special items of which specifications do not come within the ranges of specifications in the tables.

Primary pressure regulators See pages 5 and 6.

Specifications / Model number	Valve bore mm (inch)	Fluid	Primary pressure (kgf/cm²g)		do	Normal max. service temperature (°C)	do	Regulating pressure detecting method	Catalogue page(s)
			Max.	Min.					
NS60R	15 – 25 (1/2 – 1)	Gases	0.5	0.01	–	80	–	External detection	7
NS53R	20 – 150 (3/4 – 6)	Gases	0.5	0.01	–	80	–	External detection	8
NS75R	15 – 25 (1/2 – 1)	Gases and liquids	4	0.5	–	80	–	Internal detection	9, 10
NS75WR	15 – 25 (1/2 – 1)	Gases and liquids	4	0.5	–	80	–	Internal detection	9, 10
NS93R-1	15 – 25 (1/2 – 1)	Gases, liquids and steam	10	0.5	–	175 (C5191 bellows) 220 (SUS bellows)	–	External detection	11, 12
NS93R-2	20 – 150 (3/4 – 6)	Gases, liquids and steam	10	0.5	–		–	External detection	11, 12
NS185L	15 – 25 (1/2 – 1)	Gases and liquids	14	4	–	80	–	External detection	13, 14
NS185H	15 – 50 (1/2 – 2)	Gases and liquids	28	14	–	80	–	External detection	13, 14
NS185H-2	32 – 50 (1 1/4 – 2)	Gases and liquids	28	14	–	80	–	External detection	13, 14

Secondary pressure regulators See pages 15 and 16.

Specifications / Model number	Valve bore mm (inch)	Fluid	Max. primary pressure (kgf/cm²g)	Secondary pressure (kgf/cm²g)		Normal max. service temperature (°C)	Standard max. pressure ratio (primary pressure/ secondary pressure)	Regulating pressure detecting method	Catalogue page(s)
				Max.	Min.				
NS70	15 – 25 (1/2 – 1)	Gases	0.1	0.02	0	80	7/1	External detection	17
NS70W	20 – 100 (3/4 – 4)	Gases	0.1	0.02	0	80	7/1	External detection	18
NS60	15 – 25 (1/2 – 1)	Gases	2	0.5	0.02	80	10/1	External detection	19
NS53	20 – 150 (3/4 – 6)	Gases	5	0.5	0.02	80	10/1	External detection	20
NS75M	8 – 15 (1/4 – 1/2)	Gases and liquids	7	4	0.5	80	7/1	Internal detection	21, 22
NS75	15 – 25 (1/2 – 1)	Gases, liquids and steam	16	4	0.5	80 (gases and liquids) 220 (steam)	10/1	Internal detection	21, 22
NS75W	15 – 25 (1/2 – 1)	Gases and liquids	16	4	0.5	80	7/1	Internal detection	21, 22
NS93-1	15 – 25 (1/2 – 1)	Gases, liquids and steam	10	10	0.5	175 (C5191 bellows) 220 (SUS bellows)	7/1	External detection	23, 24
NS93-2	20 – 150 (3/4 – 6)	Gases, liquids and steam	10	10	0.5		7/1	External detection	23, 24
NS45	10 – 25 (3/8 – 1)	Gases	16	0.5	0.01	80	1000/1	Internal detection	25
NS77	15 – 25 (1/2 – 1)	Gases and liquids	30	4	0.5	80	20/1	Internal detection	26

Differential pressure regulators See pages 27 and 28.

Specifications / Model number	Valve bore mm (inch)	Fluid	Max. primary pressure (kgf/cm²g)	Secondary pressure (kgf/cm²g)		Normal max. service temperature (°C)	Standard max. pressure ratio (primary pressure/ secondary pressure)	Standard regulating differential pressure (kgf/cm²)		Catalogue page(s)
				Max.	Min.					
NS71	10 – 25 (3/8 – 1)	Gases	0.1	0.08	0	80	7/1	0.03	0	29
NS71W	20 – 100 (3/4 – 4)	Gases	0.1	0.08	0	80	7/1	0.03	0	30
NS61	10 – 25 (3/8 – 1)	Gases	2	0.5	0.02	80	10/1	0.48	0.03	31
NS51	20 – 150 (3/4 – 6)	Gases	5	0.5	0.02	80	10/1	0.48	0.03	32
NS40	8 – 15 (1/4 – 1/2)	Gases and liquids	7	4	0.5	80	7/1	4	0.5	33, 34
NS80	15 – 25 (1/2 – 1)	Gases and liquids	16	4	0.5	80	10/1	4	0.5	33, 34
NS80W	15 – 25 (1/2 – 1)	Gases and liquids	16	4	0.5	80	10/1	4	0.5	33, 34
NS90-1	15 – 25 (1/2 – 1)	Gases, liquids and steam	10	10	0.5	175 (C5191 bellows) 220 (SUS bellows)	7/1	7	0.5	35, 36
NS90-2	20 – 150 (3/4 – 6)	Gases, liquids and steam	10	10	0.5		7/1	7	0.5	35, 36

Pilot operated type secondary pressure regulators/Direct acting type (small capacity) See page 37.

Specifications / Model number	Valve bore mm (inch)	Fluid	Primary pressure (kgf/cm²g)		Secondary pressure (kgf/cm²g)		Normal max. service temperature (°C)	Standard max. pressure ratio (primary pressure/ secondary pressure)	Regulation pressure detecting method	Catalogue page(s)
			Max.	Min.	Max.	Min.				
NS500SI	15 – 200 (1/2 – 8)	Steam	20	3	16	0.5	300	6/1	Internal detection	38, 39, 40
NS500SM	15 – 125 (1/2 – 5)	Steam	40	16	22	5	400	4/1	Internal detection	
NS500SE	15 – 125 (1/2 – 5)	Steam	40	16	22	3	400	6/1	External detection	
NS500SH	15 – 125 (1/2 – 5)	Steam	60	40	22	7	450	6/1	External detection	
NS500GI	15 – 50 (1/2 – 2)	Steam	30	3	22	0.5	80	6/1	Internal detection	
NS510G	15 – 25 (1/2 – 1)	Steam	30	3	16	0.5	300	7/1	Internal detection	
		Gases					80			
		Liquids					220			

Primary Pressure Regulators

Installation of this valve makes it possible to regulate the fluid pressure at a constat value on the inlet side of the valve, irrespective of fluctuation in load. Set pressure is designed within a range of 28 to −1.0kgf/cm²g. For more details, see pages 6 through 14.

NAKAKITA primary pressure regulators are used as

relief valve,

back pressure regulating valve,

escape valve,

vent regulator, and

bypass regulator

for applications including

pressure regulation of various atmosphere gas generators,

pressure regulation of fuel oil line and lubricating oil line,

pressure regulation of LPG line, and

Discharge pressure regulation of pumps and receivers.

Outline of Operation

As shown in the figure below, the primary pressure is detected by the bellows (or diaphragm). When the detected value equals or exceed the set pressure, the valve plug will be lifted to release fluid from the primary side to the secondary side, and when the pressure drops below the set value, the plug will be reseated by the restoring force of the spring.

* This piping construction drawing indicates Model NS93R-2.

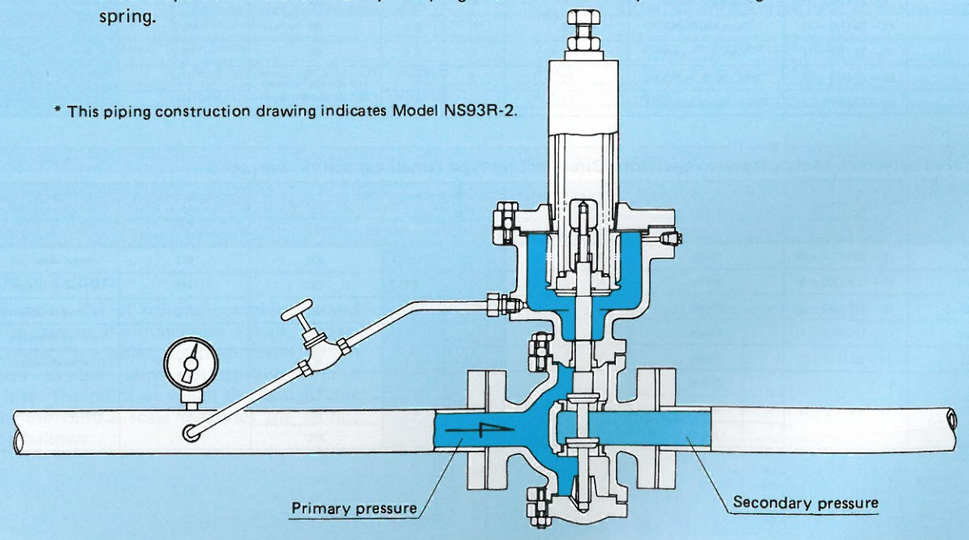


Fig. 5.1

Primary Pressure Regulators

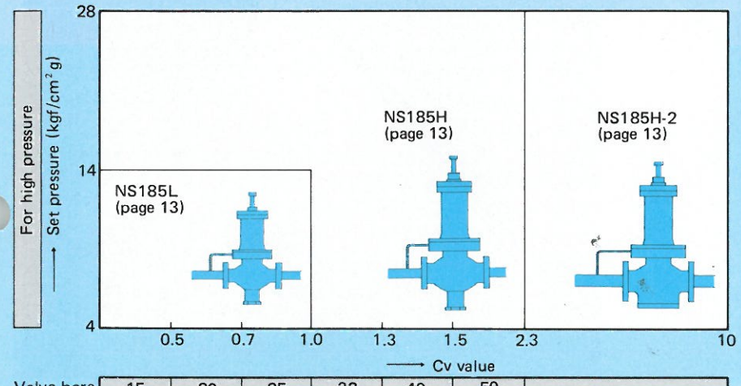
Model Selection Table

When selecting a primary pressure regulator, use the model selection table on this page and the detailed data on the following pages.

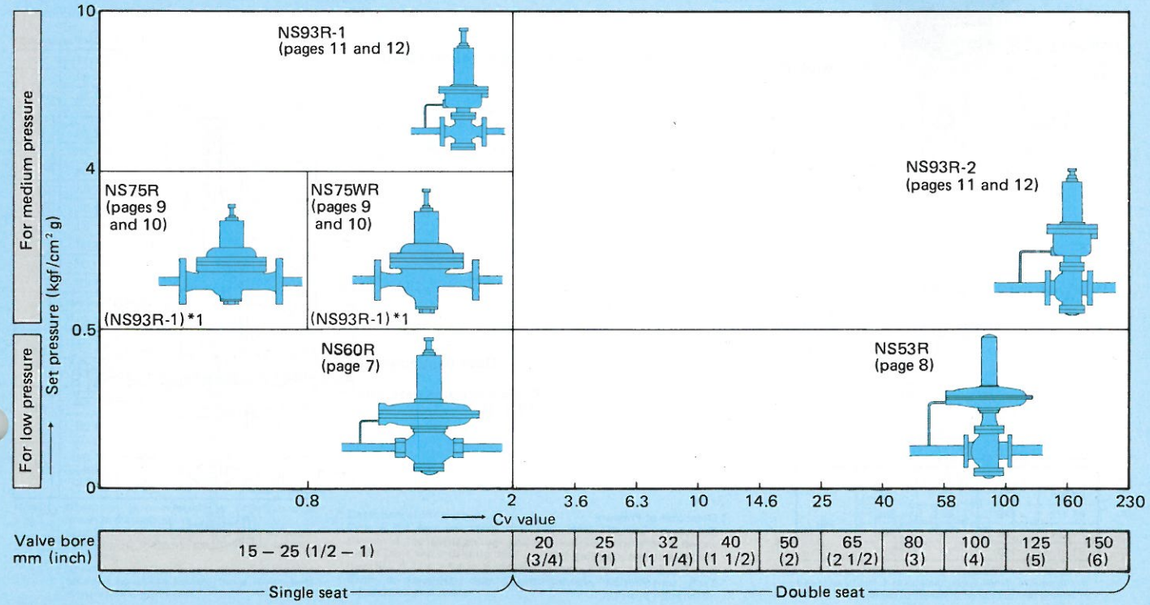
Method of Selection

1. When the bore has been determined:
   (1) First, use the selection table to select a model according to the set pressure (primary pressure) and the required bore. And see the corresponding page.
   (2) Next, use the flow rate table on the corresponding page and check whether the selected bore is sufficient to the required flow rate.
      (1) In this case, the model may be changed, or even if the model is the same one, its bore may be changed according to excess or deficiency in the flow rate.
      (2) If the valve bore can be smaller than the required pipe bore, use a reducer (our product).
2. When the bore is not determined yet:
   If the case where the bore is not determined yet, see a relevant flow rate table, since the model is determined according to the set pressure in the flow rate table. And select the model and bore corresponding to the required flow rate.
3. If you prefer not to use the flow rate tables, directly calculate the Cv value and select the model and bore corresponding to the calculated Cv value in the selection table.

Remarks: 1. Cv values in this selection table are those when the pressure deviation (offset) relative to the set pressure is 10 to 15% max.
2. For Cv values, see the separate catalogue (NAKAKITA Control Valves, CAT No. 310-3E).



*1: In this case, Model NS93R-1 is mainly for steam.

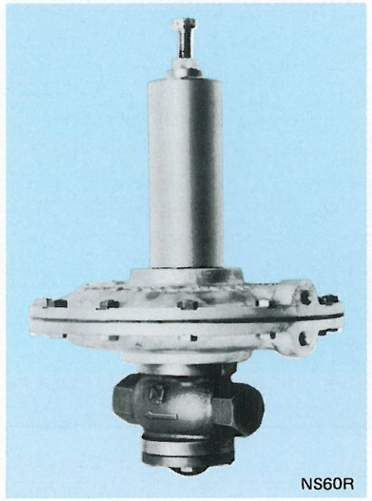


Primary Presure Regulator NS60R

- Use these models for primary pressure regulation of various gases including air.
- Specify the set pressure within the range of from 0.5 to 0.01 kgf/cm² g.
  For higher set pressures than this range, see pages 9 through 14.
- Obtain the flow rate from the flow rate table.
- Examples of application: Gas generator, combustor.

Model / Specifications	NS60R
Fluid	Air and various gases
(Set pressure) primary pressure	0.5 to 0.01 kgf/cm² g
Rangeability (Cvmax/Cvmin)	10/1 and under
Capacity	Small, Medium
Main component materials of standard products	Valve body: FC20. Cover: AC2B. Plug and seat: SUS or BC. Diaphragm: Rubber

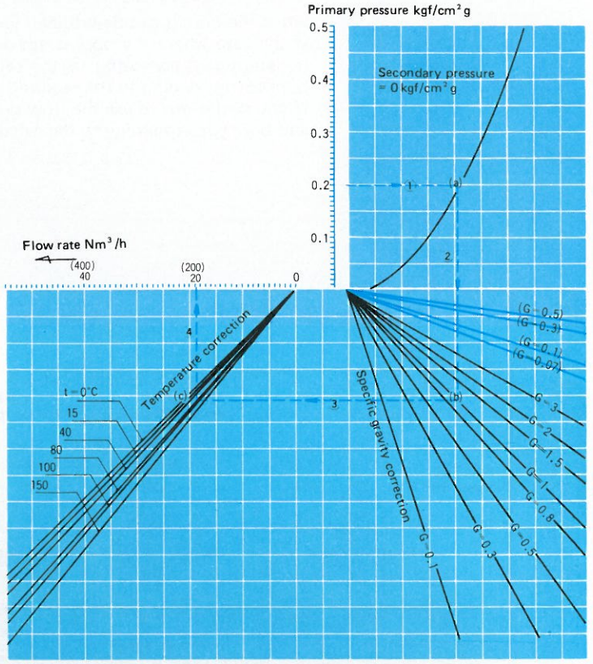
* When special material is to be used, please inform us.



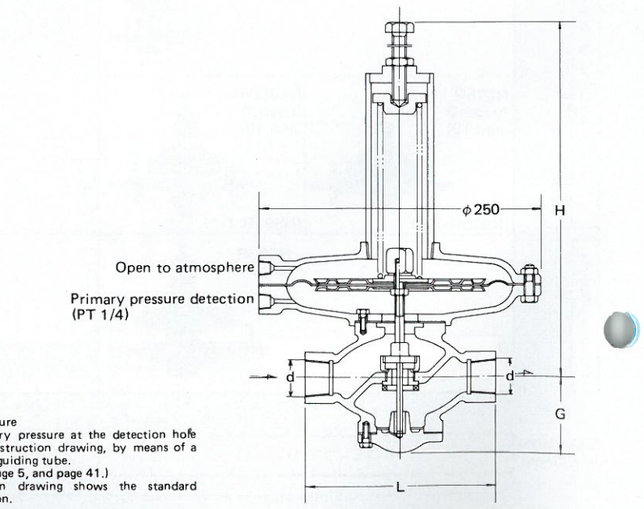
Flow Rate Table for Models NS60R

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the line of specific gravity.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Raise a vertical line through the point c to obtain the flow rate, or model and bore.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS60R



Dimensions Table of Model NS60R mm

d	L	G	H	ℓ
PT 3/8	135	58	365	150
PT 1/2	135	58	365	
PT 3/4	135	58	365	
PT 1	170	70	375	

- Flange types are also available.
- In the case of flange types, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

* Detection of Pressure
Detect the primary pressure at the detection hole shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 5.1 on page 5, and page 41.)
* Each construction drawing shows the standard installation position.

Primary Pressure Regulator NS53R

- Use these models for primary pressure regulation of various gases including air.
- Specify the set pressure within the range of from 0.5 to 0.01 kgf/cm² g.
  For higher set pressures than this range, see pages 9 through 14.
- Obtain the flow rate from the flow rate tables.
- Example of application: Gas generator, combustor.

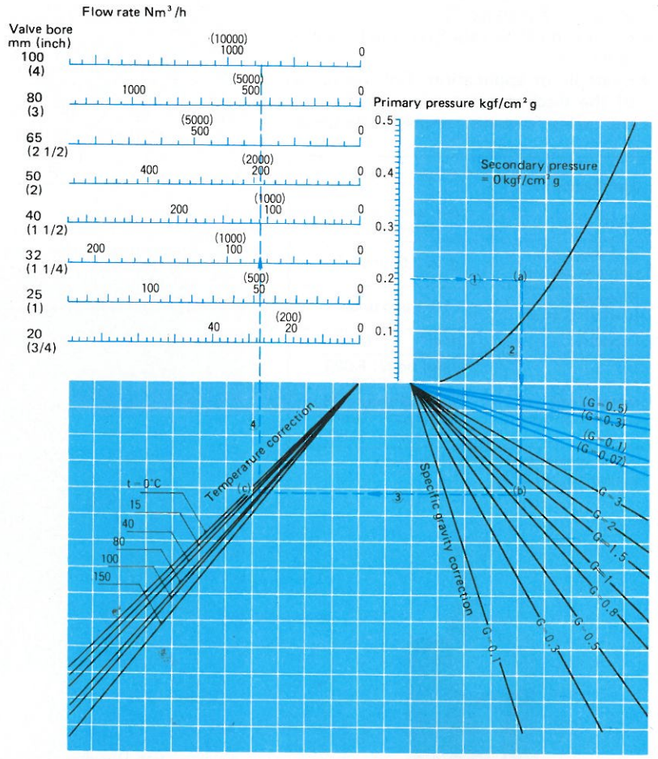
Model / Specifications	NS53R
Fluid	Air and various gases
(Set pressure) primary pressure	0.5 to 0.01 kgf/cm² g
Rangeability (Cvmax/Cvmin)	10/1 and under
Capacity	Large
Main component materials of standard products	Valve body: FC20. Cover: AC2B. Plug and seat: SUS or BC. Diaphragm: Rubber

* When special material is to be used, please inform us.

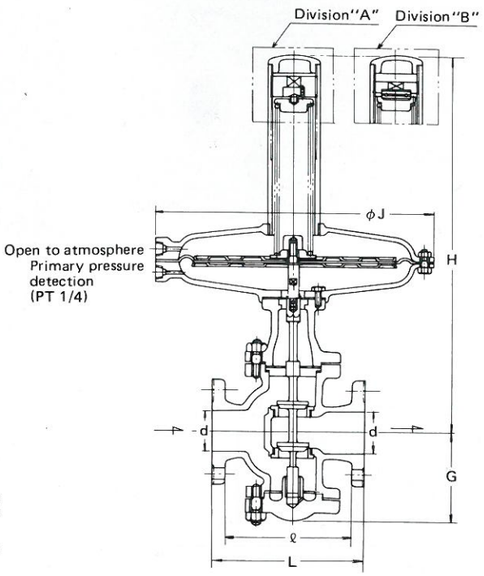
Flow Rate Table fo Models NS53R

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the line of specific gravity.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Raise a vertical line through the point c to obtain the flow rate, or model and bore.
(1) Read out the flow rate corresponding to the model and bore.
(2) Select model and bore for the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Consturction Drawing of Model NS53R



Dimensions Table of Model NS53R mm

d	Flange	L	ℓ	G	H	J
20 (3/4)	JIS 5K	202	174	90	395	250
	JIS 10K	210			415	300
25 (1)	JIS 5K	202			450	410
	JIS 10K	210				
32 (1 1/4)	JIS 5K	181	149	115	465	250
	JIS 10K	189				
40 (1 1/2)	JIS 5K	181			480	300
	JIS 10K	189				
50 (2)	JIS 5K	181			515	410
	JIS 10K	189				
65 (2 1/2)	JIS 5K	250	214	135	525	250
	JIS 10K	258			540	300
80 (3)	JIS 5K	250			580	410
	JIS 10K	258				
100 (4)	JIS 5K	328	288	205	730	360
	JIS 10K	336			755	410
					800	550
125 (5)	JIS 5K	427	387	240	810	360
	JIS 10K	435			840	410
					870	550
150 (6)	JIS 5K	497	453	280	850	360
	JIS 10K	505			890	410
					920	550

Notes:
- Dimension H corresponds to dimension J as shown in the table above.
- Classify dimension J according to the table below.
- Dimension ℓ indicates the dimension between inner faces.
- In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Diaphragm Diameter (J) mm

Bore (d)		Secondary pressure (set pressure) kgf/cm² g
80mm and under	100mm and over	
250	360	0.1 and over, and 0.5 and under
300	410	0.03 and over, and less than 0.1
410	550	0.01 and over, and less than 0.03

Division of Spring Adjusting Part

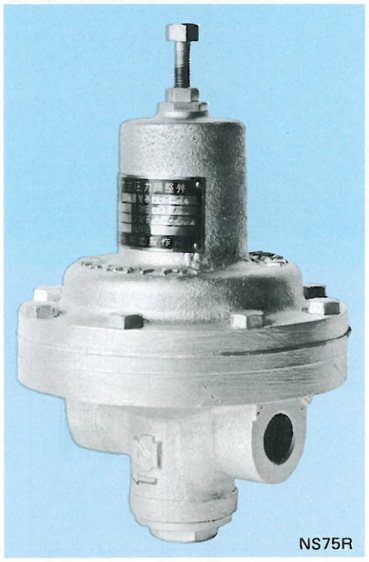
Division	Bore (d)	Secondary pressure (set pressure) kgf/cm² g
A	20 to 80mm	Less than 0.15
B	20 to 80mm	0.15 and over
	100 to 150mm	All pressures

* Detection of Pressure
Detect the primary pressure at the detection hole shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 5.1 on page 5, and page 41.)
* Each construction drawing shows the standard installation position.

- Use these models for primary pressure regulation of gases and liquids.
- Specify the set pressure within the range of from 4 to 0.5 kgf/cm² g.
  For higher set pressures than this range, see page 11 through 14.
  For lower set pressures than this range, see pages 7 through 8.
- Obtain the flow rate from the flow rate table.
- Example of application: For regulation of the discharge line pressure of equalizer pump for tank, receiver and piping.

Specifications \ Model	NS75R	NS75WR
Fluid	Air, various gases, water and oil	
(Set pressure) primary pressure	4 to 0.5 kgf/cm² g	
Rangeability (Cvmax/Cvmin)	10/1 and under	
Capacity	Small	Medium
Main component materials of standard products	Valve body: FC20. Cover: FC20. Plug and seat: SUS. Diaphragm: Rubber (for steam: SUS)	

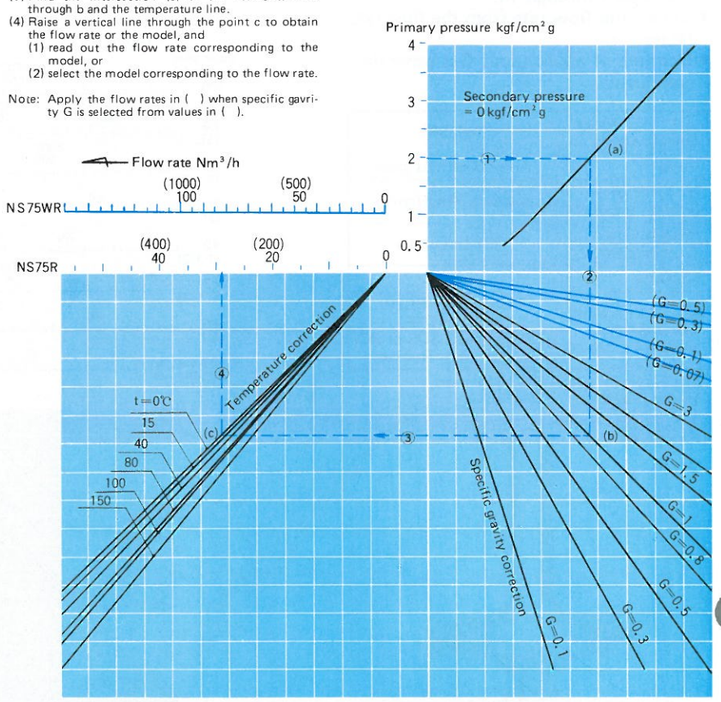
* When special material is to be used, please inform us.



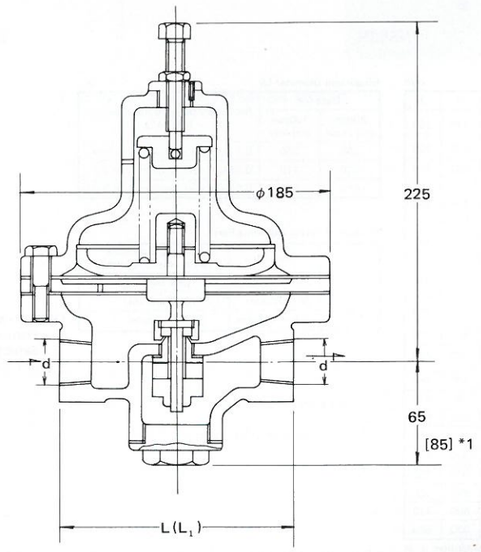
Flow Rate Table for Models NS75R and NS75WR (for Gases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the line of specific gravity.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Raise a vertical line through the point c to obtain the flow rate or the model, and
  (1) read out the flow rate corresponding to the model, or
  (2) select the model corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gavrity G is selected from values in ( ).



Construction Drawing of Model NS75R



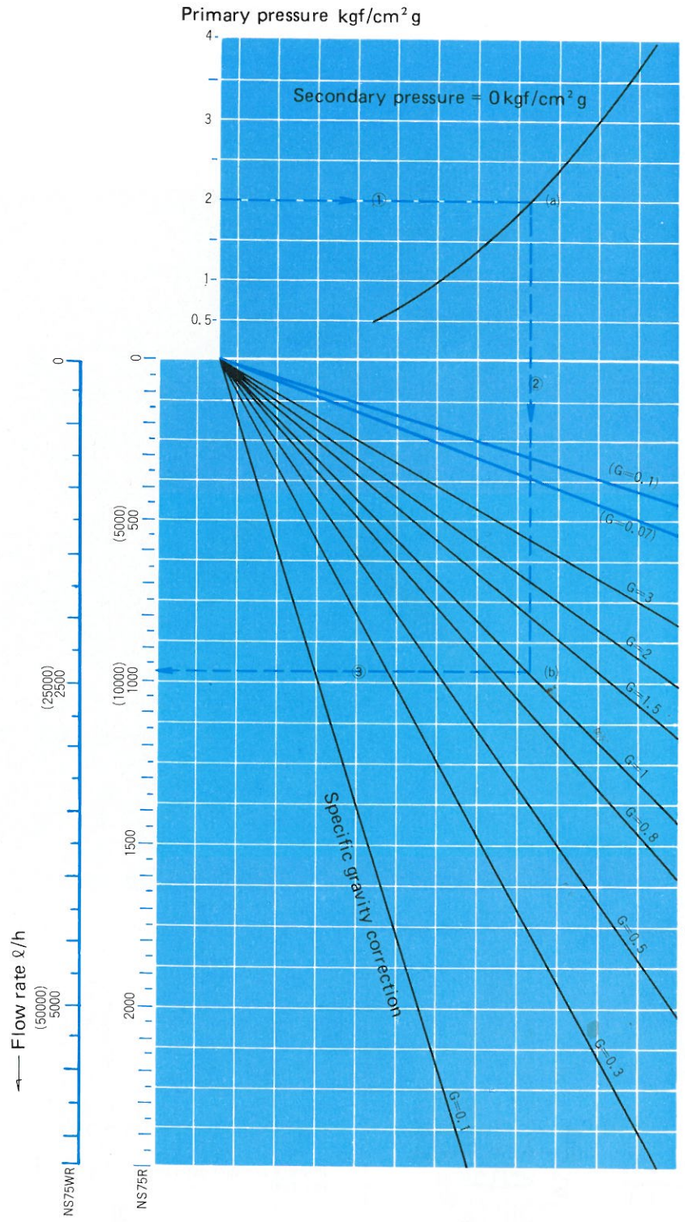
* Detection of Pressure
As this valve is an internal detection type one, no piping for external detection is required.
* The construction drawing shows the standard installation position.
*1: Dimensions in [ ] is that of Model NS75WR.

Face-to-Face dimension Table of Models NS75R and NS75WR mm

d	Flanged	L	ℓ	Threaded	L
15 (1/2)	JIS 5K	258	234	PT 1/2	140
	JIS 10K	266			
20 (3/4)	JIS 5K	262		PT 3/4	
	JIS 10K	270			
25 (1)	JIS 5K	262		PT 1	
	JIS 10K	270			

* In the case of ANSI flange types, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Flow Rate Table for Models NS75R and NS75WR (for Liquids)



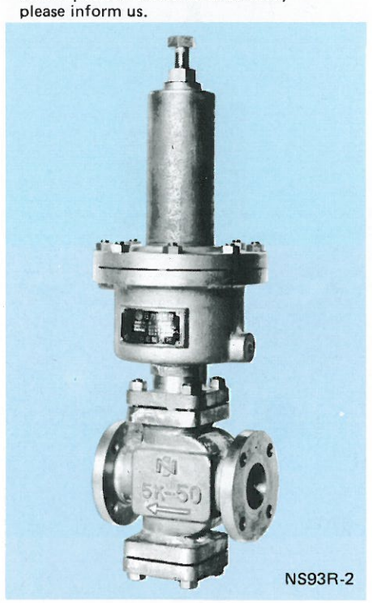
How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the line of specific gravity.
(3) Draw a horizontal line through the point b to obtain the flow rate or the model.
  (1) Read out the flow rate corresponding to the model.
  Or
  (2) Select the model corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).

- Use these models for primary pressure regulation of gases, liquids and steam.
- Specify the set pressure within the range of from 10 to 0.5kgf/cm² g.
  For higher set pressures than this range, see page 13 through 14.
  For lower set pressures than this range, see pages 7 through 10.
- Obtain the flow rate from the flow rate table.
- Example of application: For pressure equalization of tanks and receivers. For pressure regulation of lubricating oil and fuel oil lines.

Model / Specifications	NS93R-1	NS93R-2
Fluid	Air, various gases, water, oil, steam	
(Set pressure) primary pressure	10 to 0.5kgf/cm² g	
Rangeability (Cvmax/Cvmin)	10/1 and under	
Capacity	Small and medium	Large
Main component materials of standard products	Valve body: FC20. Valve plug and seat: SUS. Bellows: C5191 (fluid temperature; 175°C and under), SUS (fluid temperature; 220°C and under).	

* When special material is to be used, please inform us.

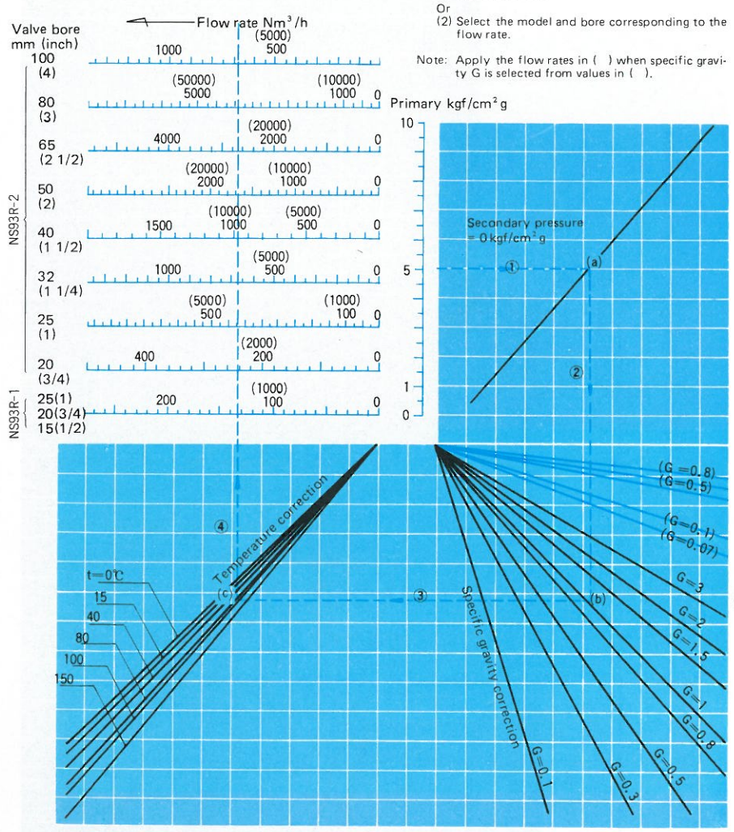


Dimensions Table of Model NS93R-1 mm

d	Flange	L	ℓ	G	H	J
15 (1/2)	JIS 5K	176	152	95	470	205
	JIS 10K	184				
	JIS 16K	184				
20 (3/4)	JIS 5K	180				
	JIS 10K	188				
	JIS 16K	188				
25 (1)	JIS 5K	180				
	JIS 10K	188				
	JIS 16K	188				

Note: Dimension ℓ indicates the dimension between the inner faces.
· In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

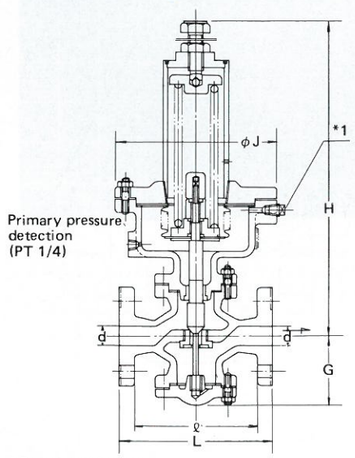
Flow Rate Table for Models NS93R-1 and NS93R-2 (for Gases)



How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Extend a vertical line through c to obtain the model or the flow rate.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.

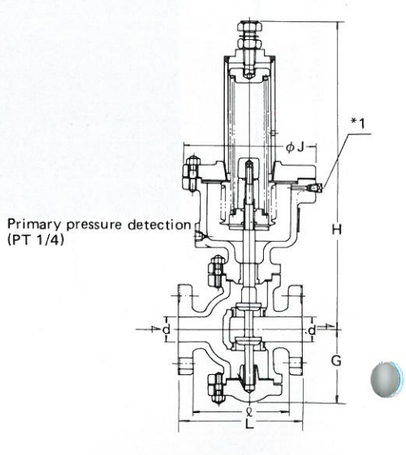
Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).

Construction Drawing oof Model NS93R-1

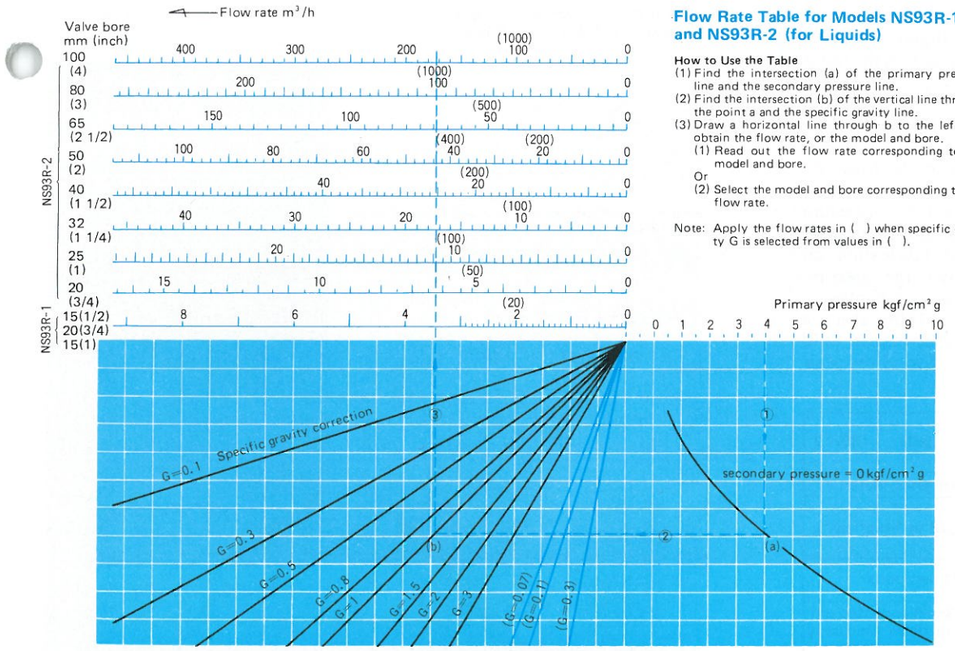


* Detection of Pressure
Detect the primary pressure at the detection hole shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 5.1 on page 5, and page 41.)
* Each construction drawing shows the standard installation position.

Construction Drawing of Model NS93R-2



*1: When the fluid is an incompressive one, disconnect this plug at the startup of operation and release the residual air.



Flow Rate Table for Models NS93R-1 and NS93R-2 (for Liquids)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Draw a horizontal line through b to the left and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).

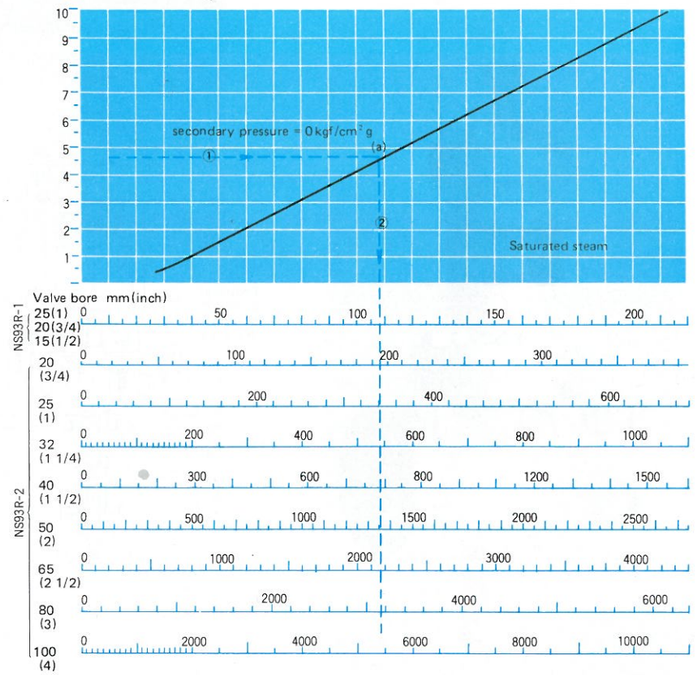
Dimensions Table of Model NS93R-2 mm

d	Flange	L	ℓ	G	H	J
20 (3/4)	JIS 5K	202	174	100	475	205
	JIS 10K	210				
	JIS 16K	210				
25 (1)	JIS 5K	202				
	JIS 10K	210				
	JIS 16K	210				
32 (1 1/4)	JIS 5K	181	149	120	590	
	JIS 10K	189				
	JIS 16K	189				
40 (1 1/2)	JIS 5K	181				
	JIS 10K	189				
	JIS 16K	189				
50 (2)	JIS 5K	181				
	JIS 10K	189				
	JIS 16K	199	159			
65 (2 1/2)	JIS 5K	250	214	140	660	
	JIS 10K	258				
	JIS 16K	258				
80 (3)	JIS 5K	250				
	JIS 10K	258				
	JIS 16K	262				
100 (4)	JIS 5K		370	–	210	855	215
	JIS 10K						
	JIS 16K						
125 (5)	JIS 5K		425	–	255	900	215
	JIS 10K						
	JIS 16K						
150 (6)	JIS 5K		475	–	290	920	215
	JIS 10K						
	JIS 16K						

· In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Flow Rate Table for Models NS93R-1 and NS93R-2 (for Steam)

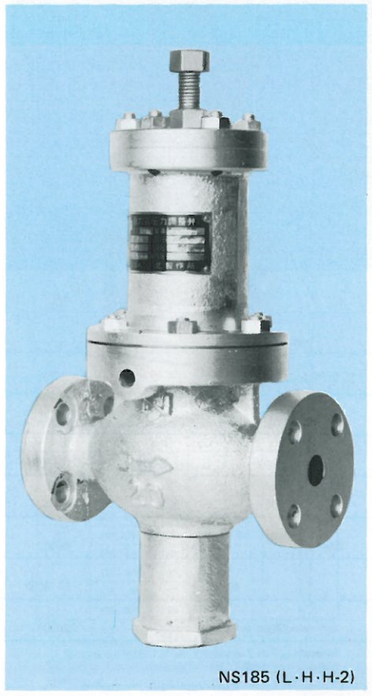
How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Draw a vertical line downward through the point a and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.



- Use these models for primary pressure regulation of gases and liquids.
- Specify the set pressure within the range of from 28 to 4 kgf/cm² g. (For details, see the specifications column.)
  For lower set pressures than this range, see pages 7 through 12.
- Obtain the flow rate from the flow rate table.
- Example of application: For pressure equalization of tanks and receivers, pressure regulation of lubricating oil and fuel oil lines, discharge pressure regulation of combustion line pumps.
- As models 185L and 185H store a manually operated valve, excess fluid can be returned irrespective of the pressure.

Specifications \ Model	185L	185H	185H-2
Fluid	Air, various gases, water, oil		
(Set pressure) primary pressure	14 to 4 kgf/cm² g	28 to 14 kgf/cm² g	
Rangeability (Cvmax/Cvmin)	10/1 and under		
Capacity	Small	Small and medium	Medium and large
Main component materials of standard products	Valve body: FC20. Main components: SUS. Diaphragm: Rubber	Valve body SCPH2. Main components: SUS (stellite). Diaphragm: Rubber	

* When special material is to be used, please inform us.

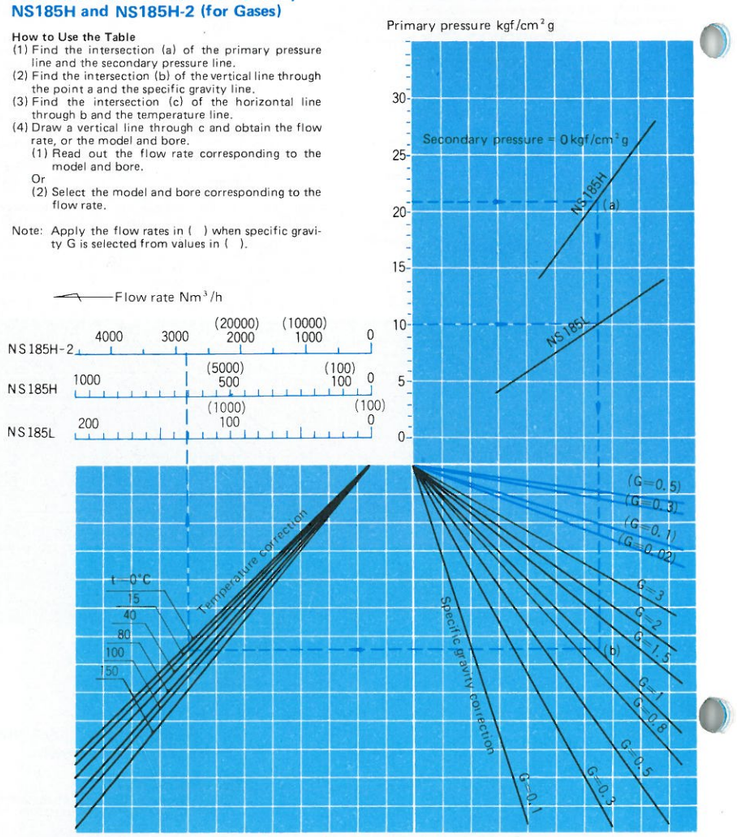


NS185 (L·H·H-2)

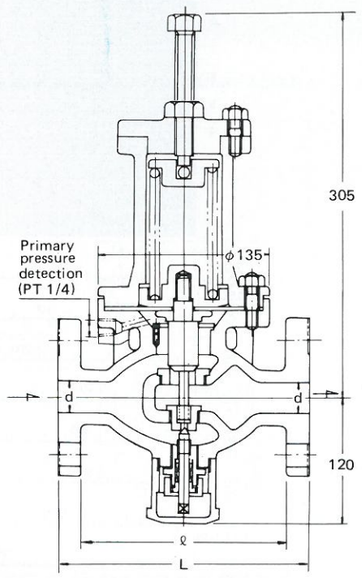
Flow Rate Table for Models NS185L, NS185H and NS185H-2 (for Gases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Draw a vertical line through c and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.

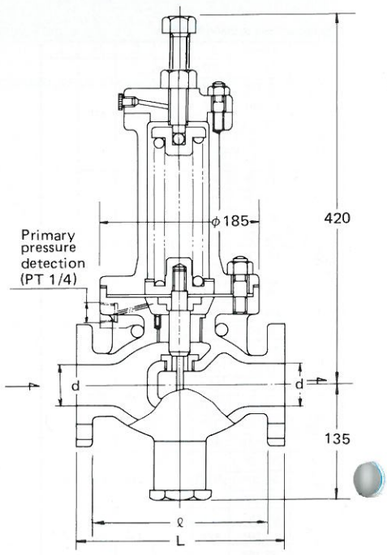
Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS185L

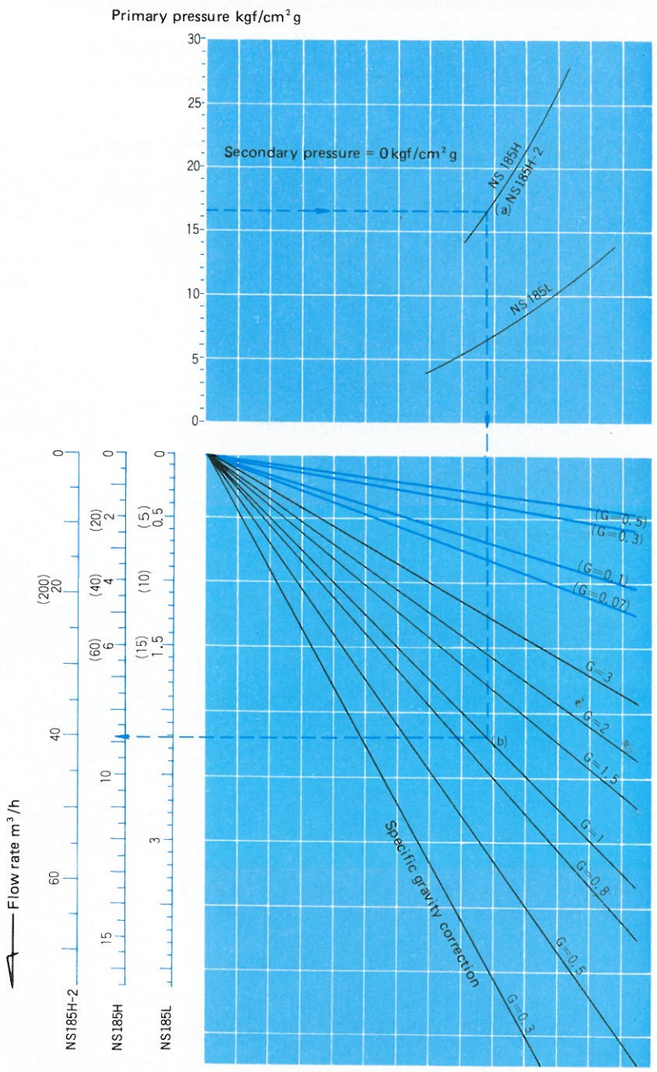


Construction Drawing of Model NS185H



* Detection of Pressure
Detect the primary pressure at the detection hole shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 5.1 on page 5, and page 41.)
* Each construction drawing shows the standard installation position.

Flow Rate Table for Models NS185L, NS185H and NS185H-2 (for Liquids)



How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Draw a horizontal line through b to the left, and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).

Face-to-Face Dimension Table of Model NS185L mm

d	Flange	L	ℓ
15 (1/2)	JIS 5K	186	
	JIS 10K	194	
	JIS 16K	194	
20 (3/4)	JIS 5K	190	
	JIS 10K	198	
	JIS 16K	198	
25 (1)	JIS 5K	190	
	JIS 10K	198	
	JIS 16K	198	

Face-to-Face Dimension Table of Model NS185H mm

d	Flange	L	ℓ
15 (1/2)	JIS 16K	228	204
	JIS 20K	232	
	JIS 30K	240	
20 (3/4)	JIS 16K	232	
	JIS 20K	236	
	JIS 30K	240	
25 (1)	JIS 16K	232	
	JIS 20K	236	
	JIS 30K	244	
32 (1 1/4)	JIS 16K	236	
	JIS 20K	240	
	JIS 30K	248	
40 (1 1/2)	JIS 16K	236	
	JIS 20K	240	
	JIS 30K	248	
50 (2)	JIS 16K	236	
	JIS 20K	240	
	JIS 30K	248	

Note: Dimension ℓ indicates the dimension between the inner faces.
· In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Secondary Pressure Regulators

Installation of this valve makes it possible to regulate the fluid pressure at a constant value on the outlet side of the valve, irrespective of fluctuation in load.
Set pressure is designed within a range of 10 to −1.0kgf/cm²g. For more details, see pages 16 through 26.

NAKAKITA secondary pressure regulators are used as

pressure reducing valve,

pressure regulator,

minimum hydraulic pressure maintaining valve, and gas equalizing valve

for applications including

pressure regulation of main and pilot lines
of various atmosphere gas generators,

pressure regulation of various oil combustor lines,

pressure regulation of LPG lines, and

pressure reducing devices from high pressure to
ultra low pressure, of various piping systems.

Outline of Operation

As shown in the figure below, the secondary pressure is detected by the diaphragm (or bellows). When the detected value shows a deviation from the set value, the valve will make a corrective action in proportion to the deviation to maintain the set pressure.

* This piping construction drawing indicates Model NS53.

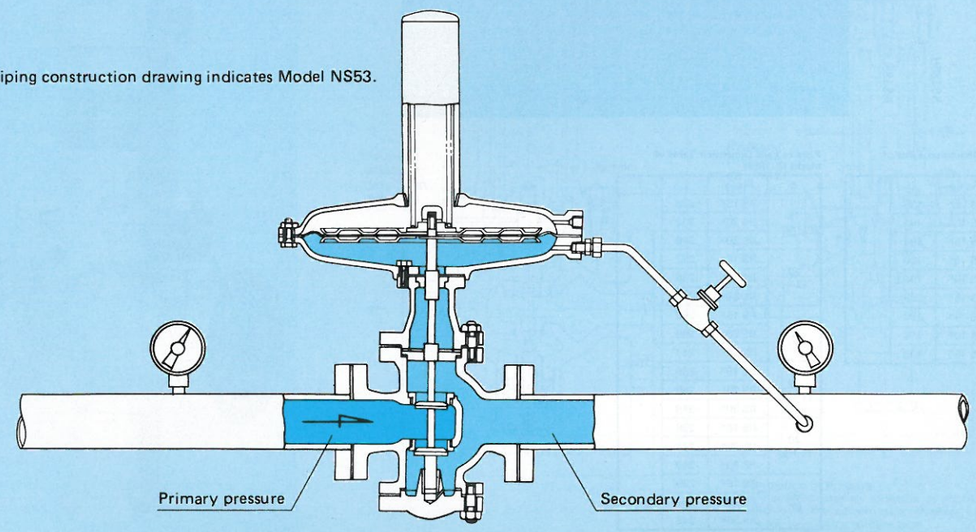


Fig. 15.1

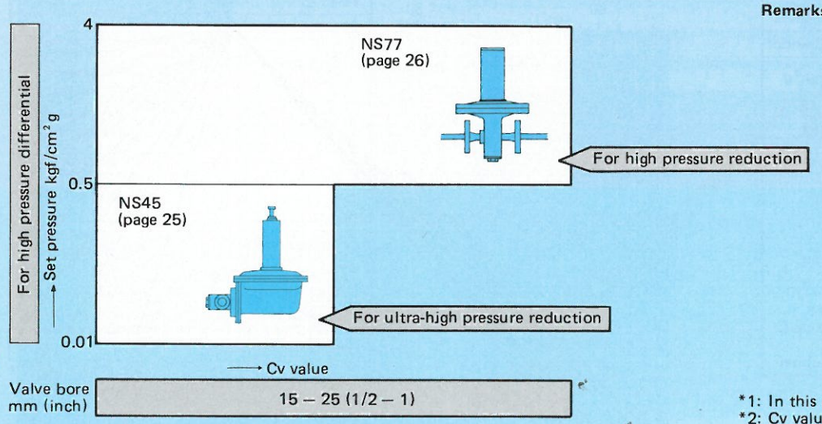
Secondary Pressure Regulators

Model Selection Table

When selecting a secondary pressure regulator, use the model selection table on this page and the detailed data on the following pages to find the most suitable one.

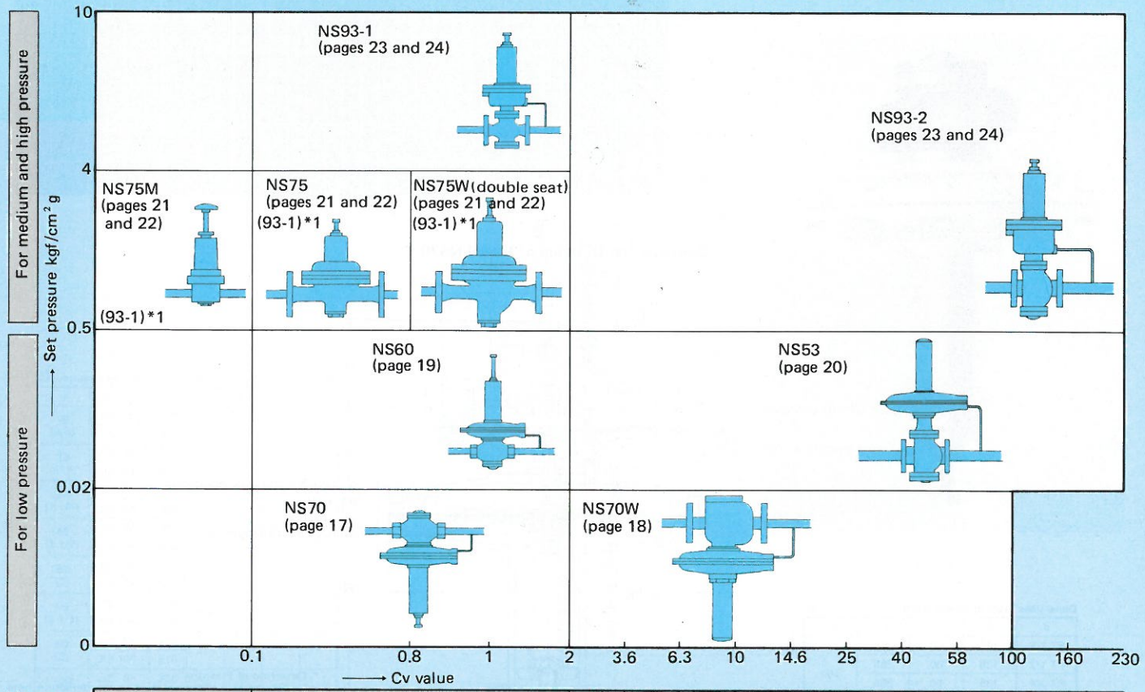
Method of Selection

1. When the bore has been determined:
   (1) First, use the selection table to select a model according to the set pressure (secondary pressure) and the required bore. And see the corresponding page.
   (2) Next, use the flow rate table on the corresponding page and check whether the selected bore is sufficient to the required flow rate.
   (1) In this case, the model may be change, or even if the model is the same one, its bore may be changed according to excess or deficiency in the flow rate.
   (2) If the valve bore can be smaller than the required pipe bore, use a reducer (our product).
2. When the bore is not determined yet:
   In the case where the bore is not determined yet, see a relevant flow rate table, since the model is the flow rate table. And select the model and bore corresponding to the required flow rate.
3. If you prefer not to use the flow rate tables, directly calculate the Cv value and select the model and bore corresponding to the calculated Cv value in the selection table.



Remarks 1. Cv values in this selection table are those when the pressure deviation (offset) relative to the set pressure is 10 to 15% max.
2. For Cv values, see the separate catalogue (NAKAKITA Control Valves, CAT No. 310-3E).

*1: In this case, Model NS93-1 is mainly for steam.
*2: Cv value of Model NS75 for steam is 0.3.

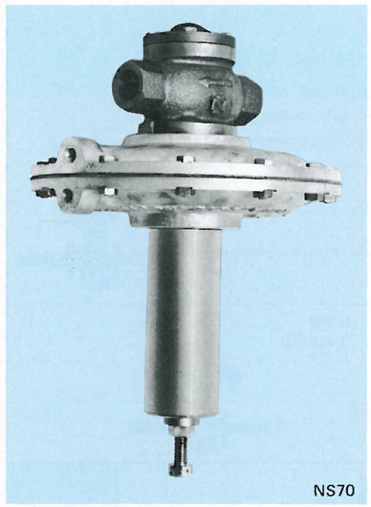


Valve bore mm (inch)	Less than 15 (1/2)	15 – 25 (1/2 – 1)	20 (3/4)	25 (1)	32 (1 1/4)	40 (1 1/2)	50 (2)	65 (2 1/2)	80 (3)	100 (4)	125 (5)	150 (6)
	Single seat		Double seat									

- Use these models for secondary pressure regulation of various gases including air.
- Specify the set pressure within the range shown in the specification column.
  For higher set pressures than this range, see pages 19 through 26.
- Obtain the flow rate from the flow rate table.
  For larger capacities, see pages 18.
- Example of application: For pressure regulation from high pressure to ultra-low pressure. By combining these models with Model NS75, less-costly and effective devices can be made.

Specifications \ Model	NS70
Fluid	Air and various gases
Primary pressure	0.1kgf/cm²g and under
(Set pressure) secondary pressure	0.02 to 0kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	7/1 and under
Minimum differential pressure (primary pres.)—(secondary pres.)	0.01kgf/cm²
Rangeability (Cvmax/Cvmin)	7/1 and under
Main component materials of standard products	Valve body: FC20. Cover: AC2B. Valve plug and seat: SUS or BC. Diaphragm: Rubber

* When special material is to be used, please inform us.

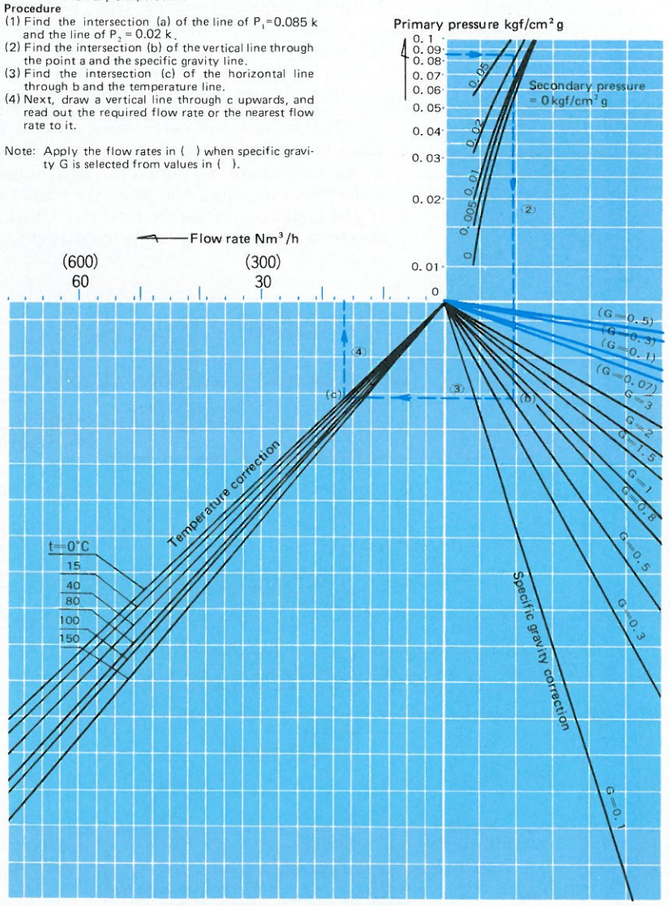


Flow Rate Table for Mldel NS70 (for Gases)

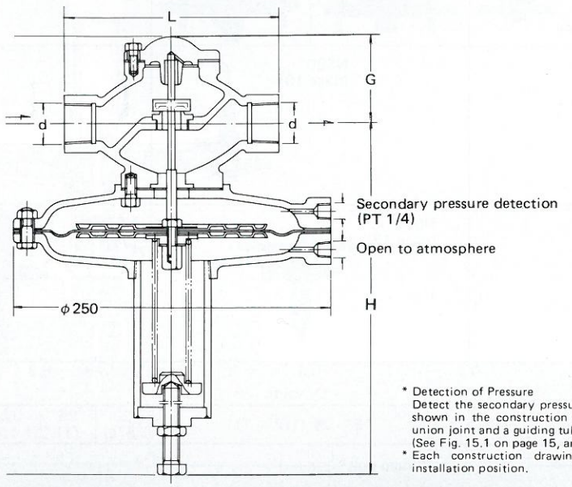
How to Use the Table
Example: Specifications
P_1 : 0.085 k → P_2 : 0.02 k
Q : 16.2 Nm³/h. Specific gravity G = 0.5 at ordinary temperature.

Procedure
(1) Find the intersection (a) of the line of P_1=0.085 k and the line of P_2 = 0.02 k.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Next, draw a vertical line through c upwards, and read out the required flow rate or the nearest flow rate to it.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS70



* Detection of Pressure
Detect the secondary pressure at the detection hole shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 15.1 on page 15, and page 41.)
* Each construction drawing shows the standard installation position.

Dimensions Table of Models NS70 mm

d	L	G	H	ℓ
PT 3/8	135	60	365	150
PT 1/2	135	60	365	
PT 3/4	135	60	365	
PT 1	170	70	375	

- Flanged types are also available.
- In the case of flanged types, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

- Use this model for secondary pressure regulation of various gases including air.
- Specify the set pressure within the range of from 200 to 0 mmAq.
  For higher set pressures than this range, see pages 19 through 26.
- Obtain the flow rate from the flow rate table.
- Example of application: Most suited for minute pressure regulation of gas main line of various combustors. By combining this model with Model NS53, less-costly and effective devices can be made.

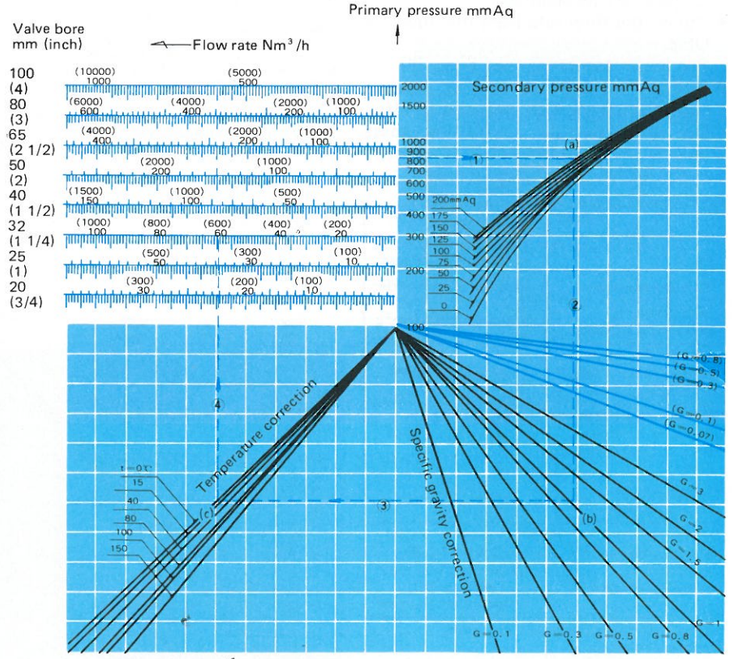
Specifications \ Model	NS70W
Fluid	Air and various gases
Primary pressure	1,000mmAq and under
(Set pressure) secondary pressure	200mmAq to 0
Standard pressure ratio (primary pres./ secondary pres.)	7/1 and under
Min. differential pressure (primary pres.)—(secondary pres.)	100mmAq
Rangeability (Cvmax/Cvmin)	7/1 and under
Main component materials of standard products	Valve body: FC20. Cover: AC2B. Valve plug and seat: SUS or BC. Diaphragm: Rubber

* When special material is to be used, please inform us.

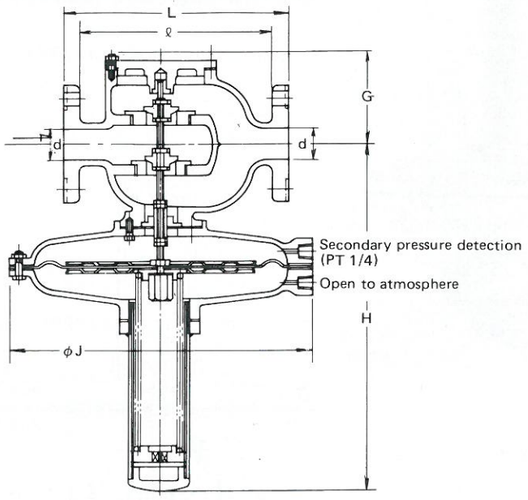
Flow Rate Table for Model NS70W (for Gases)

How to Use the Table (for Gases)
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Draw a vertical line through c and obtain the flow rate (59Nm³/h) for the bore of 32mm. Or, a bore corresponding to the flow rate can be selected.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS70W



* Detection of Pressure
Detect the secondary pressure at the detection hole shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 15.1 on page 15, and page 41.)
* Each construction drawing shows the standard installation position.

Dimensions Table of Model NS70W mm

d	Flange	L	ℓ	G	H	J
20 (3/4)	JIS 5K	218	190	85	355	250
	JIS 10K	226				
25 (1)	JIS 5K	218				
	JIS 10K	226				
32 (1 1/4)	JIS 5K	222	190	85	370	300
	JIS 10K	230				
40 (1 1/2)	JIS 5K	222				
	JIS 10K	230				
50 (2)	JIS 5K	222				
	JIS 10K	230				
65 (2 1/2)	JIS 5K	290	254	135	400	360
	JIS 10K	298				
80 (3)	JIS 5K	308	272			
	JIS 10K	316				
100 (4)	JIS 5K	355	315	150	450	410
	JIS 10K	363				

Note: Dimension ℓ indicates the dimension between the inner faces.
- In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

- Use these models for secondary pressure regulation of various gases including air.
- Specify the set pressure within the range shown in the specification column.
  For higher set pressures than this range, see pages 21 through 26.
- Obtain the flow rate from the flow rate table.
  For larger capacities, see pages 20.
- Example of application: For pressure regulation from high pressure to ultra-low pressure. By combining these models with Model NS75, less-costly and effective devices can be made.

Specifications \ Model	NS60
Fluid	Air and various gases
Primary pressure	2kgf/cm²g and under
(Set pressure) secondary pressure	0.5 to 0.02 kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	10/1 and under
Minimum differential pressure (primary pres.)—(secondary pres.)	0.01kgf/cm²
Rangeability (Cvmax/Cvmin)	10/1 and under
Main component materials of standard products	Valve body: FC20. Cover: AC2B. Valve plug and seat: SUS or BC. Diaphragm: Rubber

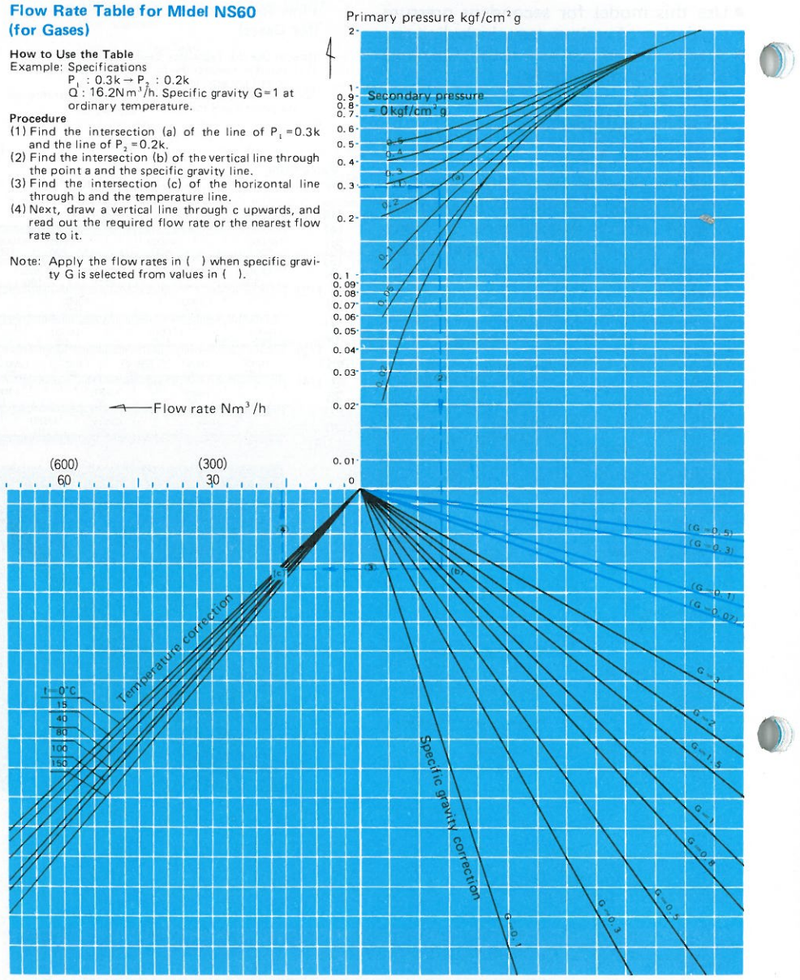
* When special material is to be used, please inform us.

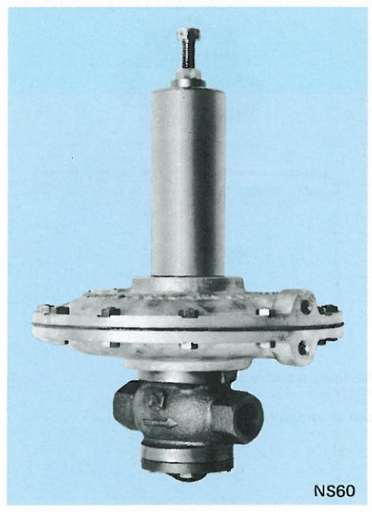
Flow Rate Table for MIdel NS60 (for Gases)

How to Use the Table
Example: Specifications
P_1 : 0.3k → P_2 : 0.2k
Q : 16.2Nm³/h. Specific gravity G=1 at ordinary temperature.

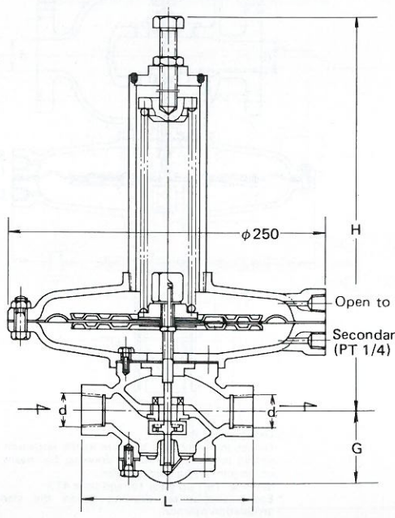
Procedure
(1) Find the intersection (a) of the line of P_1=0.3k and the line of P_2=0.2k.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Next, draw a vertical line through c upwards, and read out the required flow rate or the nearest flow rate to it.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).




NS60

Construction Drawing of Model NS60



* Detection of Pressure
Detect the secondary pressure at the detection hole shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 15.1 on page 15, and page 41.)
* Each construction drawing shows the standard installation position.

Dimensions Table of Models NS60 mm

d	L	G	H	ℓ
PT 3/8	135	60	365	150
PT 1/2	135	60	365	
PT 3/4	135	60	365	
PT 1	170	70	375	

- Flanged types are also available.
- In the case of flanged types, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

- Use this model for secondary pressure regulation of various gases including air.
- Specify the set pressure within the range of from 0.5 to 0.02kgf/cm²
  For higher set pressures than this range, see pages 21 through 26.
  For lower set pressures than this range, see pages 17 and 18.
- Obtain the flow rate from the flow rate table.
  For smaller capacities than this, use Model NS60.
- Example of application: Specially suited to large capacity control of low pressure line of general air piping, and of LPG main line of various combustors.

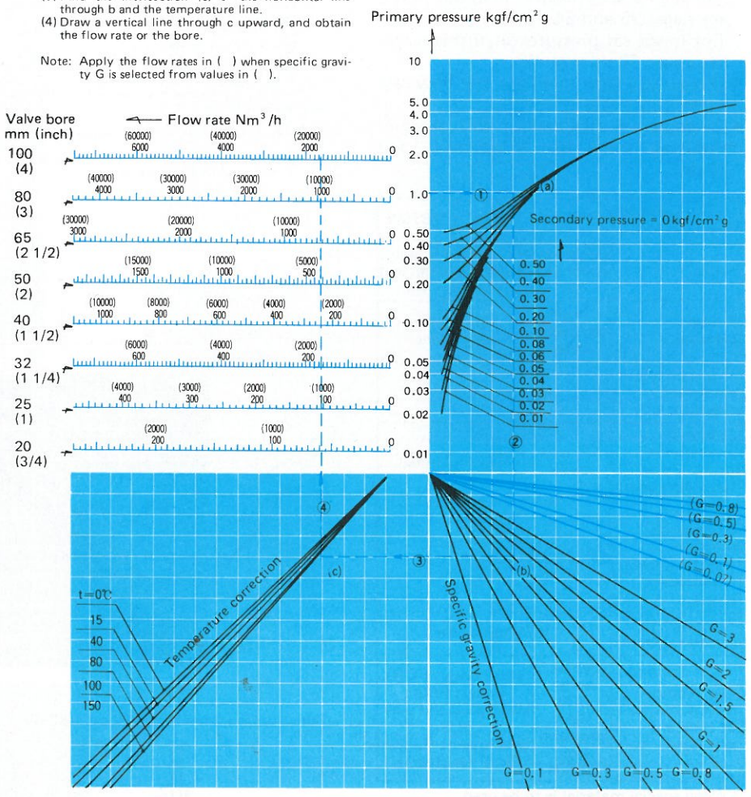
Specifications \ Model	NS53
Fluid	Air and various gases
Primary pressure	5kgf/cm²g and under
(Set pressure) secondary pressure	0.5 to 0.02kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	10/1 and under
Min. differential pressure (primary pres.)—(secondary pres.)	0.1 x (secondary pres. + 0.1) kgf/cm²
Rangeability (Cvmax/Cvmin)	10/1 and under
Main component materials of standard products	Valve body: FC20. Cover: AC2B Valve plug and seat: SUS or BC. Diaphragm: Rubber

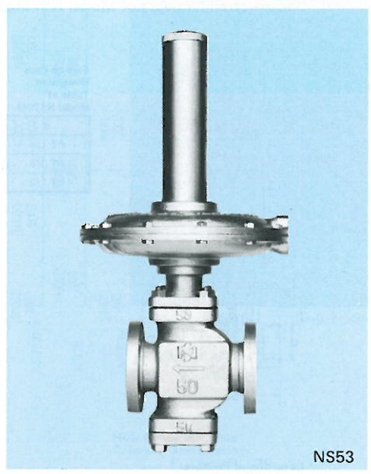
* When special material is to be used, please inform us.

Flow Rate Table for Model NS53 (for Gases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Draw a vertical line through c upward, and obtain the flow rate or the bore.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).




NS53

Diaphragm Diameter (J) mm

Bore (d)		Secondary pressure (set pressure) kgf/cm²g
80mm and under	100mm and over	
250	360	0.1 and over, and 0.5 and under
300	410	0.03 and over, and less than 0.1
410	550	0.01 and over, and less than 0.03

Division of Spring Adjusting Part

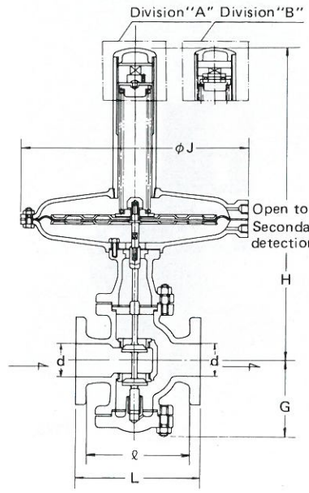
Division	Bore (d)	Secondary pressure (set pressure) kgf/cm²g
A	20 to 80mm	Less than 0.15
B	20 to 80mm	0.15 and over
	100 to 150mm	All pressures

Dimensions Table of Model NS53 mm

d	Flange	L	ℓ	G	H	J
20 (3/4)	JIS 5K	202	174	90	395	250
	JIS 10K	210			415	300
25 (1)	JIS 5K	202			450	410
	JIS 10K	210				
32 (1 1/4)	JIS 5K	181	149	115	465	250
	JIS 10K	189				
40 (1 1/2)	JIS 5K	181			480	300
	JIS 10K	189				
50 (2)	JIS 10K	181			515	410
	JIS 10K	189				
65 (2 1/2)	JIS 5K	250	214	135	525	250
	JIS 10K	258			540	300
80 (3)	JIS 5K	250			580	410
	JIS 10K	258				
100 (4)	JIS 5K	328	288	205	730	360
	JIS 10K	336			755	410
					800	550
125 (5)	JIS 5K	427	387	240	810	360
	JIS 10K	435			840	410
					870	550
150 (6)	JIS 5K	497	453	280	850	360
	JIS 10K	505			890	410
					920	550

Notes:
- Dimension H corresponds to dimension J as shown in the table above.
- Classify dimension J according to the table below.
- Dimension ℓ indicates the dimension between the inner faces.
- In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Construction Drawing of Model NS53

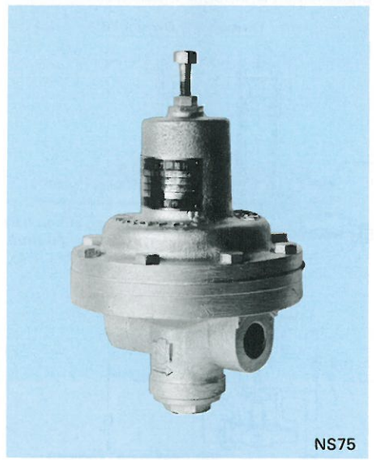


* Detection of Pressure
Detect the secondary pressure at the detection hole as shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 15.1 on page 15, and page 41.)
* Each construction drawing shows the standard installation position.

- Use these models for secondary pressure regulation of gases and liquids. Model NS75 is available for steam.
- Specify the set pressure within the range of from 4 to 0.5kgf/cm² g.
  For higher set pressures than this range, see pages 23 and 24.
  For lower set pressures than this range, see pages 17 through 20.
- Obtain the flow rate from the flow rate table.
- Example of application: For pressure reducing lines for 16kgf/cm² g and under.

Specifications \ Model	NS75M	NS75	NS75W
Fluid	Air, gases, water and oil	Air, gases, water, oil and steam	Air, gases, water and oil
Primary pressure	7kgf/cm²g and under	16kgf/cm²g and under	
(Set pressure) secondary pressure	4 to 5kgf/cm²g		
Standard pressure ratio (primary pres./ secondary pres.)	7/1 and under	10/1 and under	
Minimum differential pressure (primary pres.) −(secondary pres.)	0.5kgf/cm²		
Rangeability Cvcmax/Cvmin)	10/1 and under		
Main component materials of standard products	Valve body: BC6. Valve plug and seat: C3604	Valve body: FC20. Cover: FC20. Valve plug and seat: SUS. Diaphragm: Rubber (SUS for steam)	

* When special material is to be used, please inform us.



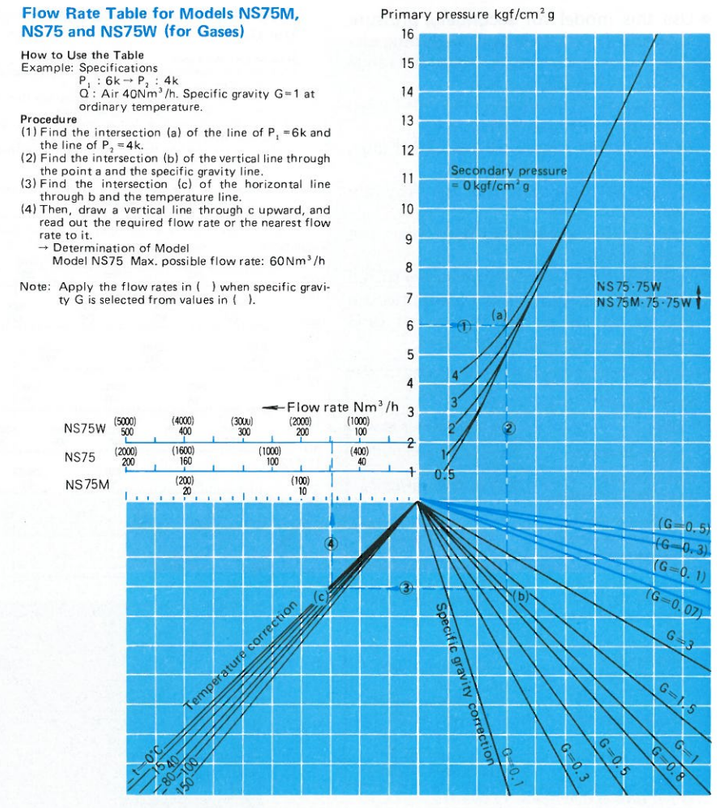
NS75

Flow Rate Table for Models NS75M, NS75 and NS75W (for Gases)

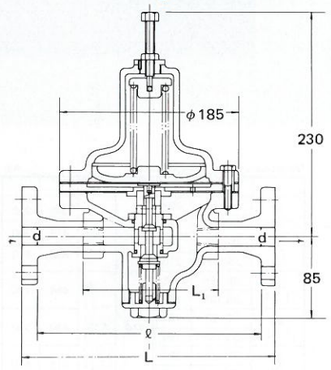
How to Use the Table
Example: Specifications
P_1 : 6k → P_2 : 4k
Q : Air 40Nm³/h. Specific gravity G=1 at ordinary temperature.

Procedure
(1) Find the intersection (a) of the line of P_1 =6k and the line of P_2 =4k.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Then, draw a vertical line through c upward, and read out the required flow rate or the nearest flow rate to it.
→ Determination of Model
Model NS75 Max. possible flow rate: 60Nm³/h

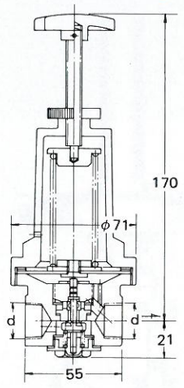
Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS75W



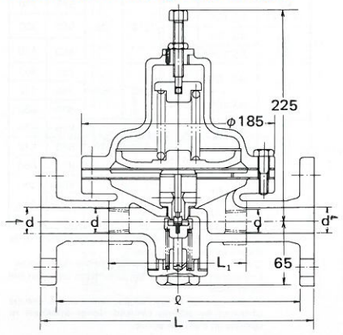
Construction Drawing of Model NS75M



Face-to-Face Dimension Table of Model NS75M

d
PT 1/4
PT 3/8
PT 1/2

Construction Drawing of Model NS75



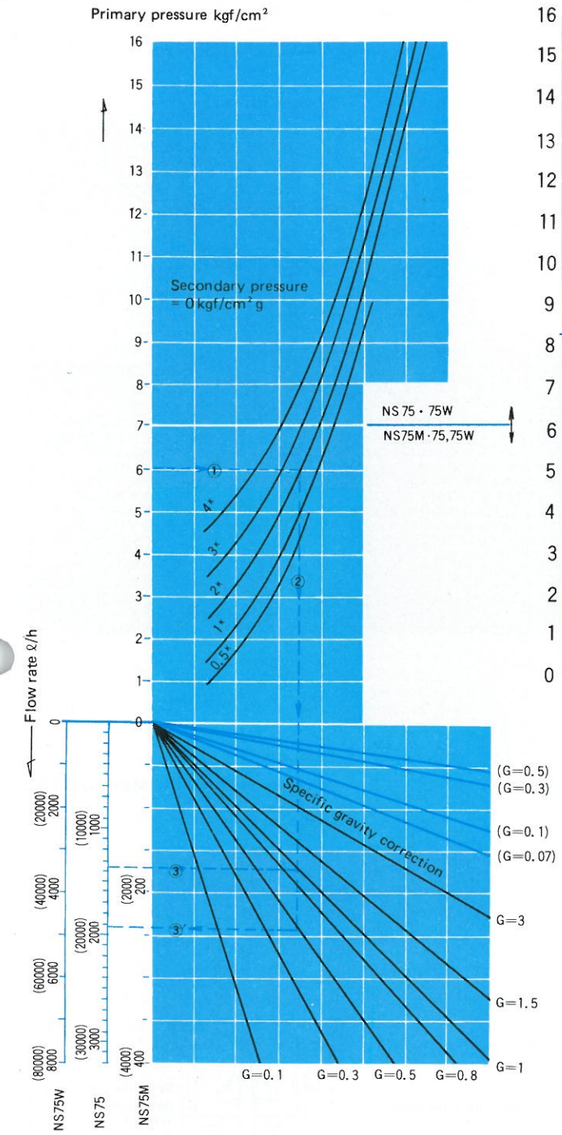
* Detection of Pressure
As these valves are of internal detection type, no external detection piping is required.
* Each construction drawing shows the standard installation position.

Face-to-Face Dimension Table of Models NS75 and NS75W mm

d	Flange	L	ℓ	Threaded	L_1
15 (1/2)	JIS 5K	258	234	PT 1/2	140
	JIS 10K	266			
20 (3/4)	JIS 5K	262		PT 3/4	
	JIS 10K	270			
25 (1)	JIS 5K	262		PT 1	
	JIS 10K	270			

* In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Flow Rate Table for Models NS75M, NS75 and NS75W (for Liquids)

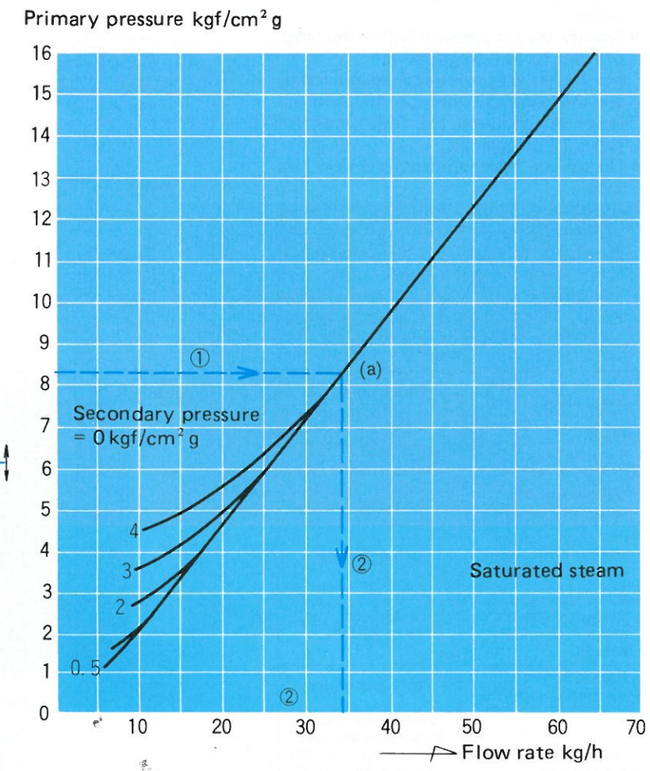


How to Use the Table
Example: Specifications
P_1 : 6k → P_2 : 2k
Q : Water, 1,200ℓ/hr. Specific gravity G=1

Procedure
(1) Find the intersection (a) of the line of P_1 =6k and the line of P_2 =2k.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Draw a horizontal line to the left through b and read out the required flow rate or the nearest flow rate to it.
→ Determination of Model
Model NS75 Max. possible flow rate: 1,370ℓ/hr
If specific gravity G=0.5 as is the case of 3', the max. flow rate is 1,930ℓ/hr.)

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).

Flow Rate Table for Model NS75 (for Steam)

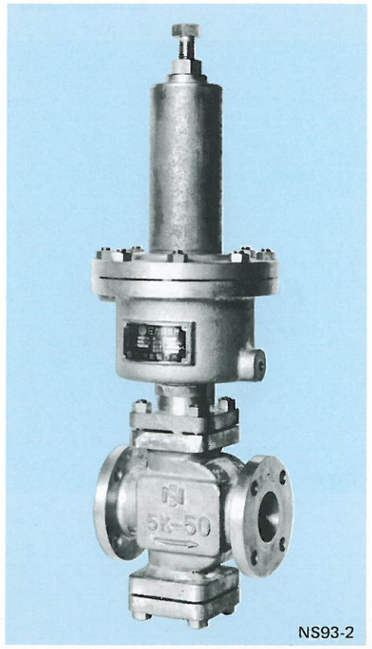


How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Draw a vertical line through the point a down ward and obtain the flow rate.

- Use these models for secondary pressure regulation of gases, liquids and steam.
- Specify the set pressure within the range of from 10 to 0.5kgf/cm² g.
  For higher set pressures than this range, see the pages 37 through 40. And for lower set pressures than this range, see pages 17 through 22.
- Obtain the flow rate from the flow rate table.
- Example of application: For regulation of medium pressure lines on land and on board the ship. Specially popular for lubricating oil and fuel oil lines. By combining these models with Model NS53, 10kgf/cm² g line pressure can be reduced to 0.5kgf/cm² g and under.

Specifications \ Model	NS93-1/NS93-2
Fluid	Air, various gases, water, oil, steam
Primary pressure	10kgf/cm²g and under
(Set pressure) secondary pressure	10 to 0.5kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	7/1 and under
Min. differential pressure (primary pres.)—(secondary pres.)	0.1 (secondary pres. + 5) kgf/cm²
Rangeability (Cvmax/Cvmin)	10/1 and under
Main component materials of standard products	Valve body: FC20. Valve plug and seat: SUS. Bellows: C5191 (fluid temp. 175°C and under), SUS (fluid temp. 220°C and under)

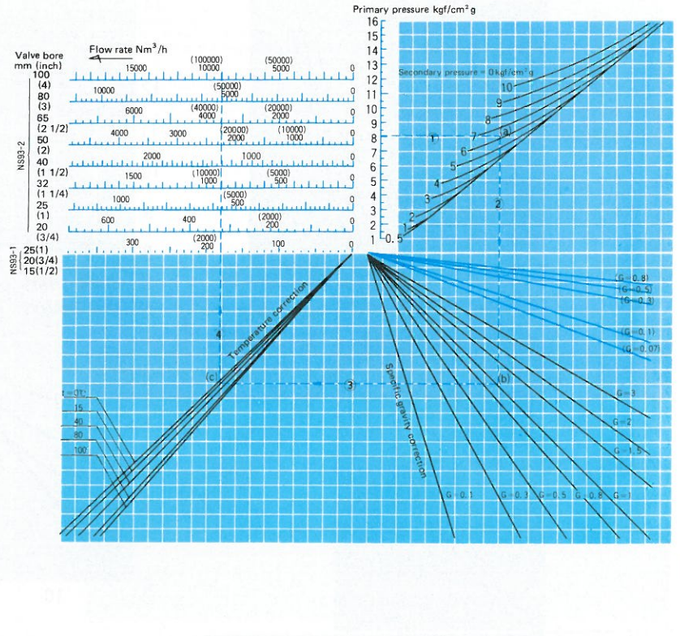
* When special material is to be used, please inform us.



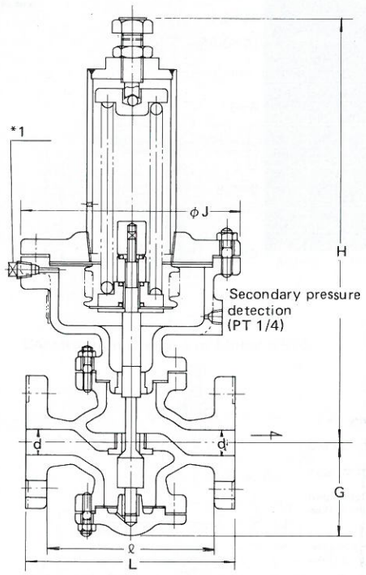
Flow Rate Table of Models NS93-1 and NS93-2 (for Gases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Draw a vertical line through c upward, and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the mode and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).

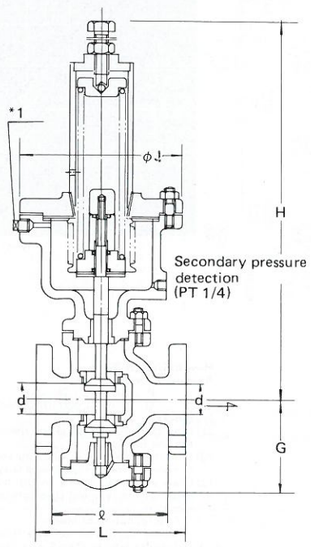


Construction Drawing of Model NS93-1



* Detection of Pressure
Detect the secondary pressure at the detection hole shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 15.1 on page 15, and page 41.)
* Each construction drawing shows the standard installation position.

Construction Drawing of Model NS93-2

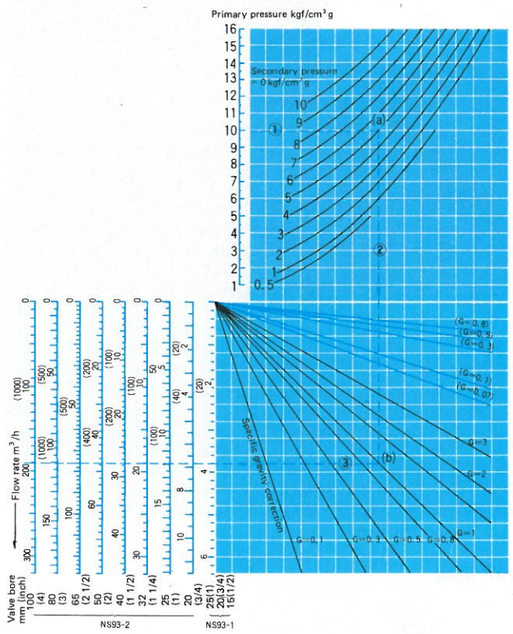


*1: When the fluid is an incompressive one, disconnect this plug at the startup of operation and release the residual air.

Flow Rate Table of Models NS93-1 and NS93-2 (for Liquids)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Draw a horizontal line through b to the left, and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Dimensions Table of Model NS93-2 mm

d	Flange	L	ℓ	G	H	J
20 (3/4)	JIS 5K	202	174	100	475	205
	JIS 10K	210				
	JIS 16K	210				
25 (1)	JIS 5K	202				
	JIS 10K	210				
	JIS 16K	210				
32 (1 1/4)	JIS 5K	181	149	120	590	
	JIS 10K	189				
	JIS 16K	189				
40 (1 1/2)	JIS 5K	181				
	JIS 10K	189				
	JIS 16K	189				
50 (2)	JIS 5K	181				
	JIS 10K	189				
	JIS 16K	199	159			
65 (2 1/2)	JIS 5K	250	214	140	660	
	JIS 10K	258				
	JIS 16K	258				
80 (3)	JIS 5K	250				
	JIS 10K	258				
	JIS 16K	262				
100 (4)	JIS 5K	370	–	210	855	215
	JIS 10K					
	JIS 16K					
125 (5)	JIS 5K	425	–	255	900	215
	JIS 10K					
	JIS 16K					
150 (6)	JIS 5K	475	–	290	920	215
	JIS 10K					
	JIS 16K					

* In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

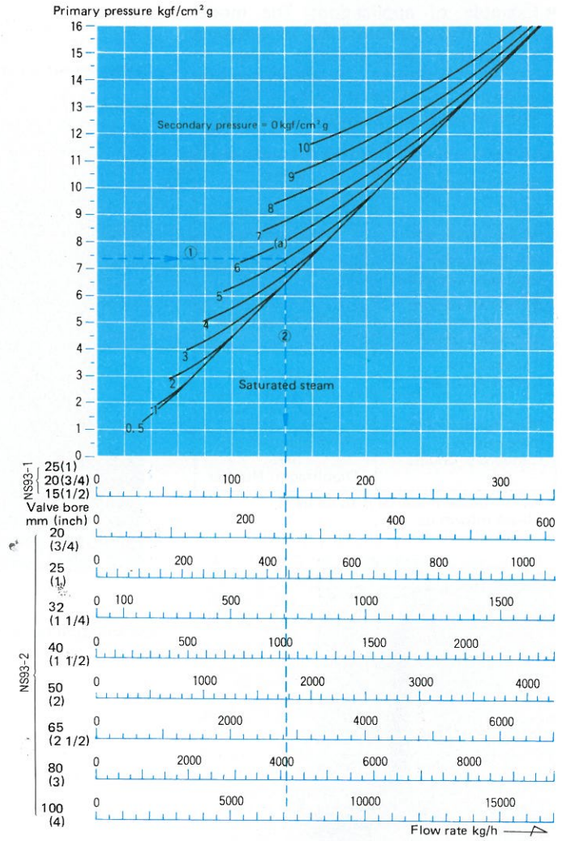
Dimensions Table of Model NS93-1 mm

d	Flange	L	ℓ	G	H	J
15 (1/2)	JIS 5K	176	152	95	470	205
	JIS 10K	184				
	JIS 16K	184				
20 (3/4)	JIS 5K	180				
	JIS 10K	188				
	JIS 16K	188				
25 (1)	JIS 5K	180				
	JIS 10K	188				
	JIS 16K	188				

Note: • Dimension ℓ indicates dimension between the inner faces.
• In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Flow Rate Table for Models NS93-1 and NS93-2 (for Steam)

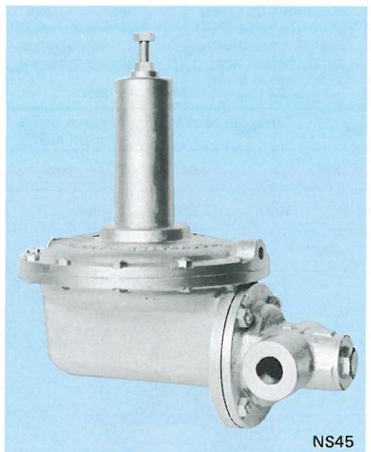
How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Draw a vertical line through the point a and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.



- Use this model for secondary pressure regulation of various gases including air.
- Specify the set pressure within the range of from 0.5 to 0.01 kgf/cm² g.
  For higher set pressures that this range, see pae 26.
  For lower set pressures than this range, see pges 17 and 19.
- Obtain the flow rate from the flow rate table.
- Example of application: The model shows high performance in reducing 16 kgf/cm² g line pressure down to 0.5~0.01 kgf/cm² g. The secondary side is almost free from the effects of large fluctuation in the primary pressure.

Specifications \ Model	NS45
Fluid	Air, various gases
Primary pressure	16kgf/cm²g
(Set pressure) secondary pressure	0.5 to 0.01kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	1,000/1 and under
Rangeability (Cvmax/Cvmin)	10/1 and under
Main components materials of standard products	Valve body: FC20. Cover: AC2B. Valve plug and seat: SUS. Diaphragm: Rubber

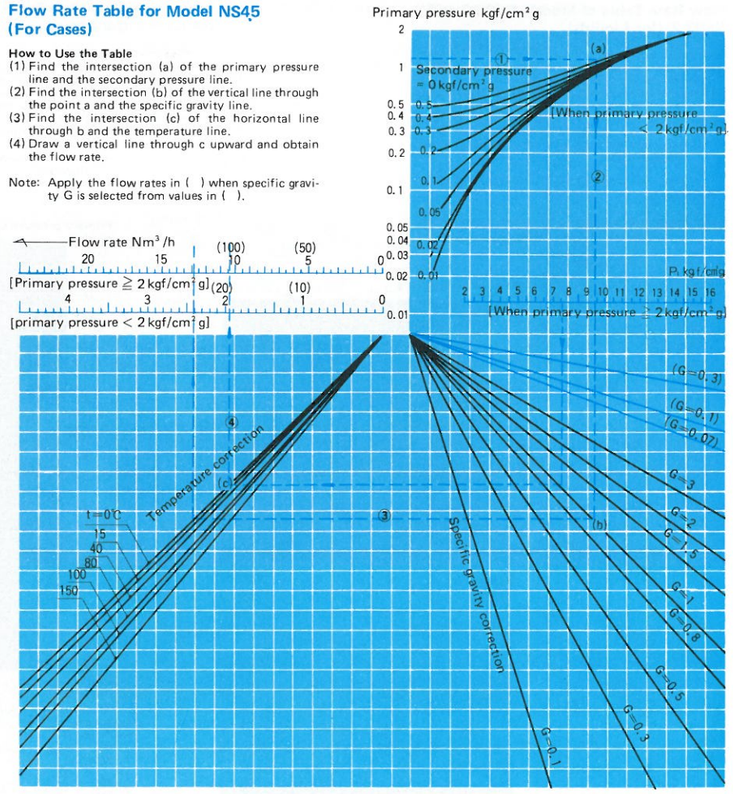
* When special material is to be used, please inform us.



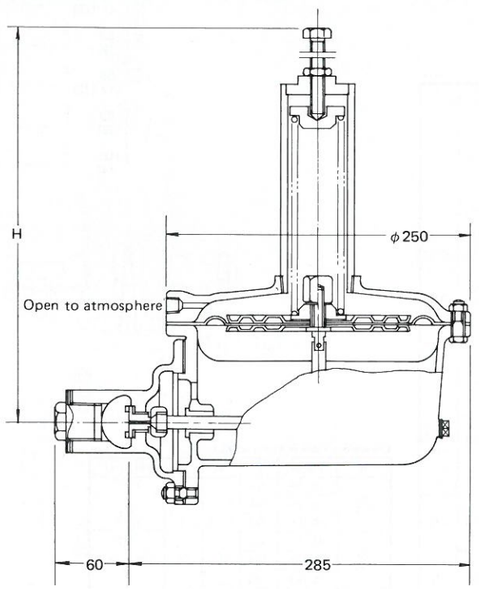
Flow Rate Table for Model NS45 (For Cases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Draw a vertical line through c upward and obtain the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS45



* Detection of Pressure
As this valve is of internal detection type, no external detection piping is required.
* The construction drawing shows the standard installation position.
* Flange types are also available.
* In the case of flanged types, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Dimensions Table of Model NS45 mm

d	Face-to-face dimension	H	ℓ
PT 3/8	135	370	216
PT 1/2			
PT 3/4			
PT 1			

* Flange types are also available.
* In the case of flanged types, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

- Use this model for secondary pressure regulation of gases and liquids.
- Specify the set pressure within the range of from 4 to 0.5 kgf/cm² g.
  For lower set pressure than this range, see page 25.
- Obtain the flow rate from the flow rate table.
- Example of application: With its excellent pressure resistance, it is popular as the minimum hydraulic pressure maintaining valve of fuel oil lines. It reduces 30 kgf/cm² g line to 2~1.5 kgf/cm² g.

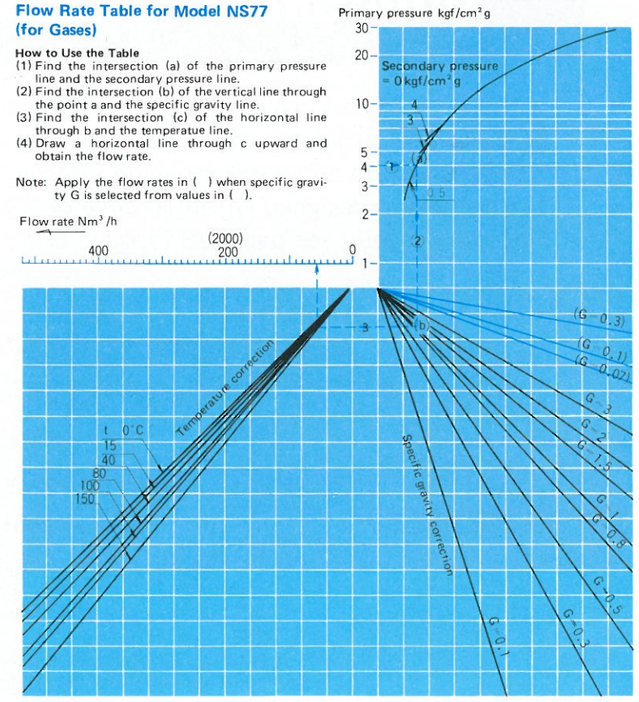
Specifications \ Model	NS77
Fluid	Air, various gases, water and oil
Primary pressure	30kgf/cm²g and under
(Set pressure) secondary pressure	4 to 0.5kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	20/1 and under
Min. differential pres. (primary pres.)—(secondary pres.)	2kgf/cm²
Rangeability (Cvmax/Cvmin)	10/1 and under
Main component materials of standard products	Valve body: SCPH2. Cover: S25C. Valve plug and seat: SUS (stellite). Diaphragm: Rubber

* When special material is to be used, please inform us.

Flow Rate Table for Model NS77 (for Gases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperatue line.
(4) Draw a horizontal line through c upward and obtain the flow rate.

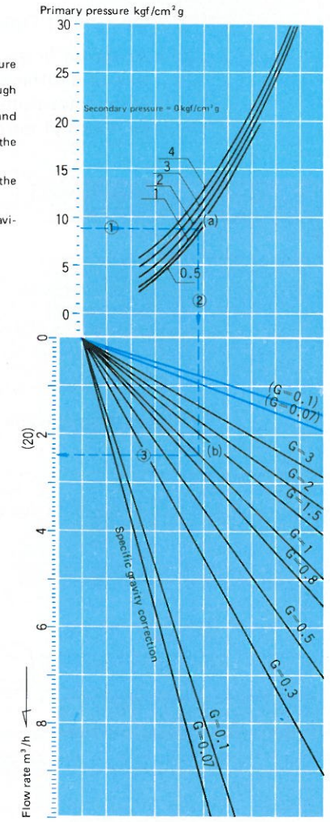
Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



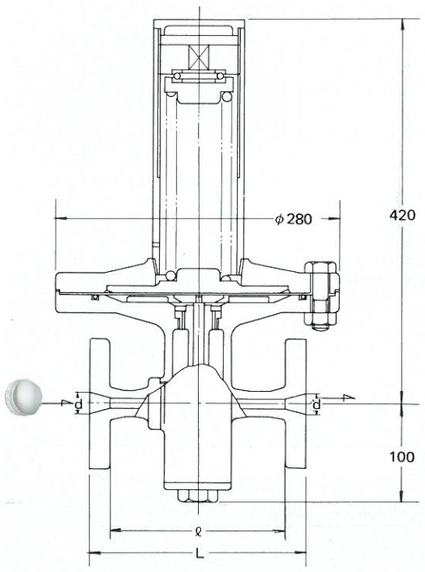
Flow Rate Table for Model NS77 (for Liquids)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Draw a horizontal line through b to the left and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS77



Face-to-Face Dimension Table of Model NS77 mm

d	Flange	L	ℓ
15 (1/2)	JIS 5K	192	174
	JIS 10K, 16K	198	
	JIS 20K	202	
	JIS 30K	210	
20 (3/4)	JIS 5K	194	
	JIS 10K, 16K	202	
	JIS 20K	206	
	JIS 30K	210	
25 (1)	JIS 5K	194	
	JIS 10K, 16K	202	
	JIS 20K	206	
	JIS 30K	214	

Note: Dimension ℓ indicates dimension between the inner faces.

* Detection of Pressure
As this valve is of internal pressure detection type, no external piping for detection is required.
* The construction drawing shows the standard installation position.
· In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Differential Pressure Regulators

Installation of this valve makes it possible to regulate the pressure differential between the outlet (or the inlet) side of this valve and the line pressure of a different system at a constant value, irrespective of fluctuation in load.
Set pressure is designed within a range of 7 to 0 kgf/cm^2 g.
For more details, see pages 28 through 36.

NAKAKITA Differential pressure regulators are used as

constant differential pressure valve,

ratio regulator,

zero regulator, and

equalizing valve

for applications including

main line of various atmosphere gas generators,

oil line pressure regulation of boiler combustors, and
pressure regulation of main line of fire-extinguish equipment

Outline of Operation

As shown in the figure below, the secondary pressure and the loading pressure (line pressure of a different system) are detected at the lower side and the upper side of the diaphragm (or bellows), respectively. The valve maintains the specified differential pressure by means of the adjusting spring stored in the valve.

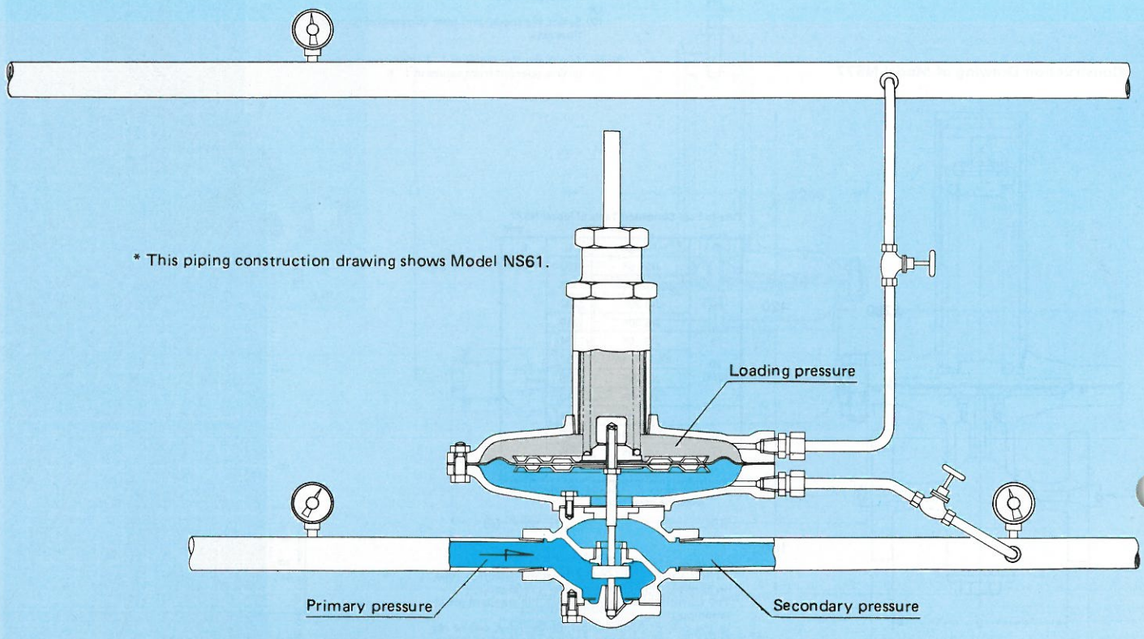


Fig. 27.1

Differential Pressure Regulators

Model Selection Table

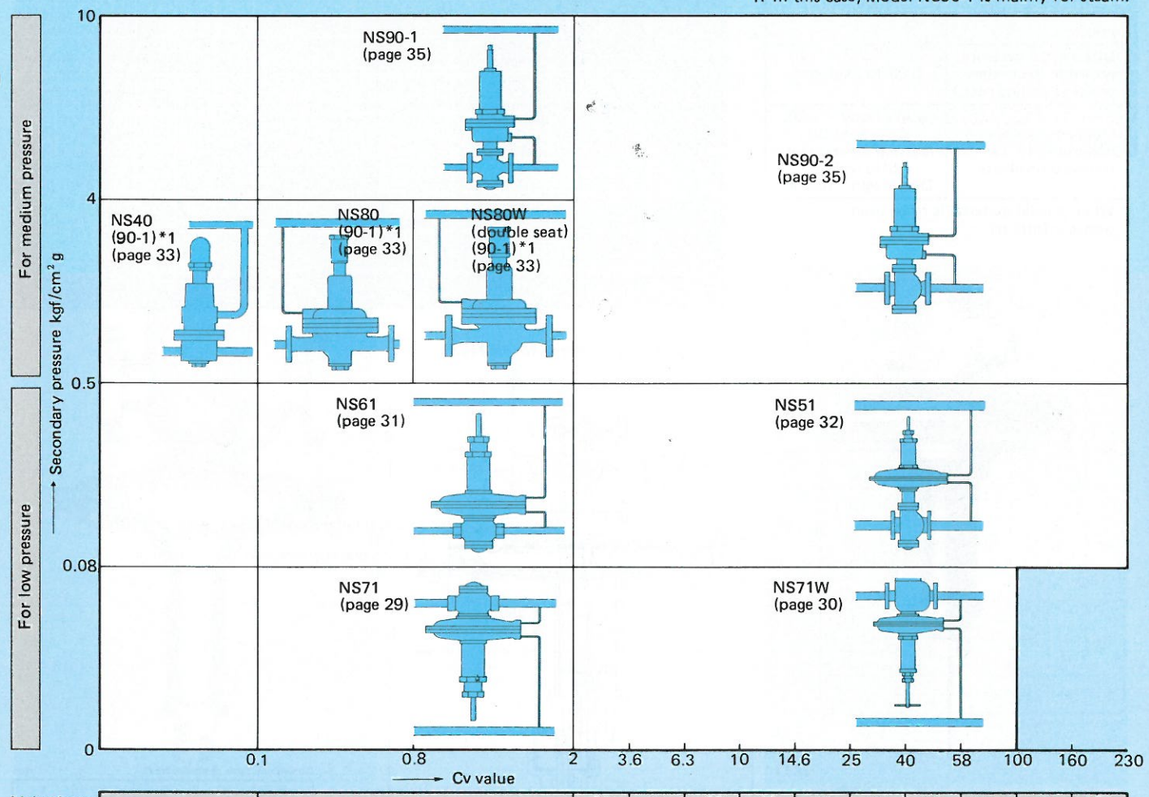
When selecting a differential pressure regulator, use the model selection table on this page and the detailed data on the following pages to find the most suitable one.

Method of Selection

1. When the bore has been determined:
   (1) First, use the selection table to select a model according to the set pressure (secondary pressure – loading pressure) and the required bore. And see the corresponding page.
   (2) Next, use the flow rate table on the corresponding page and check whether the selected bore is sufficient to the required flow rate.
   (1) In this case, the model may be changed, or even if the model is the same one, its bore may be changed according to excess or deficiency in the flow rate.
   (2) If the valve bore can be smaller than the required pipe bore, use a reducer (our product).
2. When the bore is not determined yet:
   In the case where the bore is not determined yet, see a relevant flow rate table, since the model is determined according to the set pressure in the flow rate table. And select the model and bore corresponding to the required flow rate.
3. If you prefer not to use the flow rate tables, directly calculate the Cv value and select the model and bore corresponding to the calculated Cv value in the selection table.

Remarks: 1. Cv values in this selection table are those when the pressure deviation (offset) relative to the set pressure is 10 to 15% max.
2. For Cv values, see the separate catalogue (NAKAKITA Control Valves, CAT No. 310-3E).

*1: In this case, Model NS90-1 is mainly for steam.

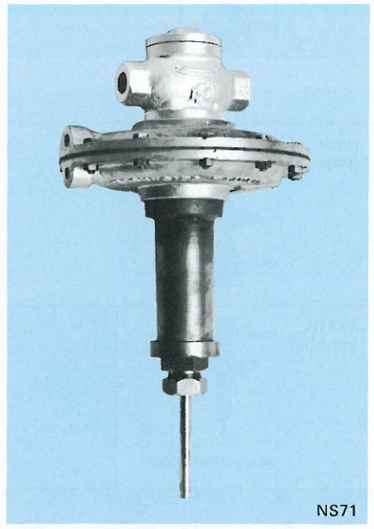


Valve bore mm (inch)	Less than 15 (1/2)	15 – 25 (1/2 – 1)	20 (3/4)	25 (1)	32 (1 1/4)	40 (1 1/2)	50 (2)	65 (2 1/2)	80 (3)	100 (4)	125 (5)	150 (6)
	Single seat		Double seat									

- Use these models for differential pressure regulation of various gases including air.
- Specify the set pressure (P_2-LP) within the range of 300 to 0 mmAq.
  (1) P_2 stands for the secondary pressure, and LP for the loading pressure.
  (2) Secondary pressure and loading pressure are shown in the specifications column.
  (3) For higher set differential pressures than these ranges, see pages 31 and 36.
- Obtain the flow rate from the flow rate table.
  For larger capacities than those, see page 30.
- Example of application: Various atmosphere gas generators and combustors.

Specifications \ Model	NS71
Fluid	Air, various gases
Primary pressure	0.1kgf/cm²g and under
Secondary pressure	0.08 to 0kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	7/1 and under
Min. differential pressure (primary pres.)—(secondary pres.)	7/1 and under
Differential pressure set value (secondary pres.)—(loading pres.)	0.03 to 0kgf/cm²
Main component materials of standard products	Valve body: FC20. Cover: AC2B. Valve plug and seat: SUS or BC. Diaphragm: Rubber.

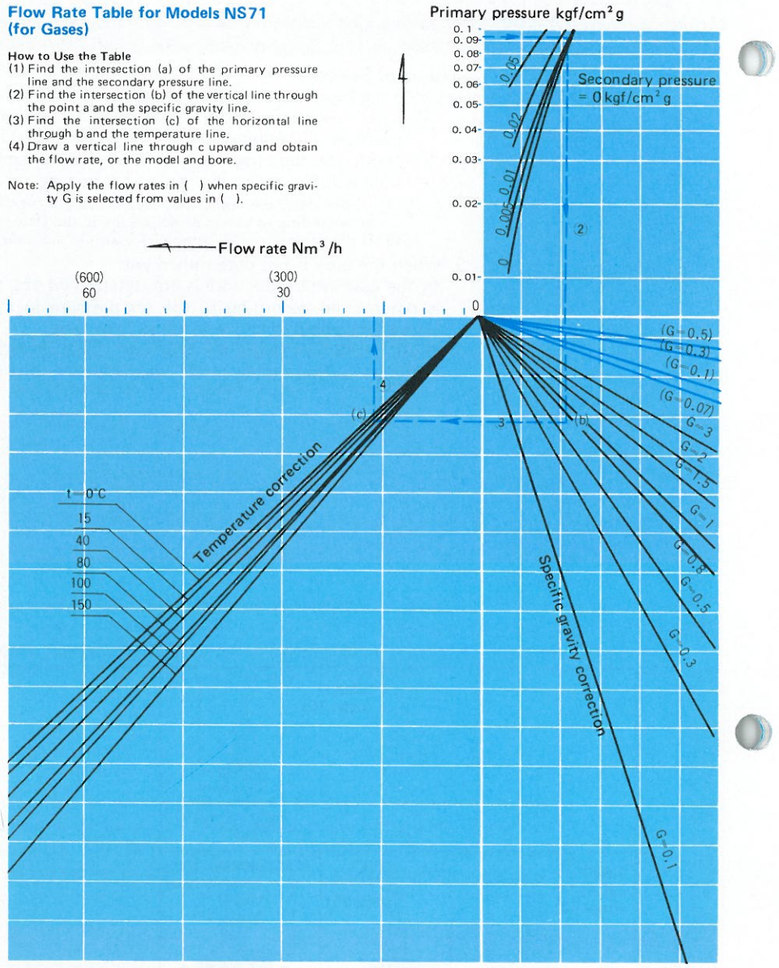
* When special material is to be used, please inform us.


NS71

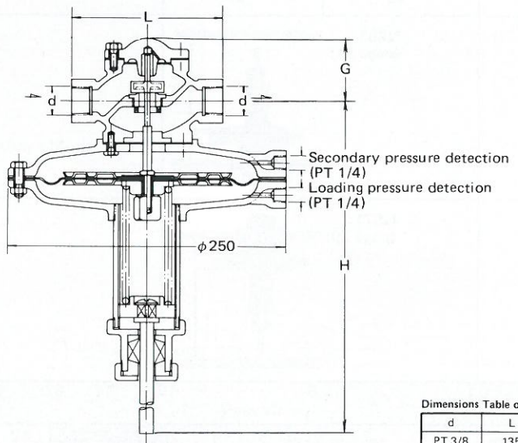
Flow Rate Table for Models NS71 (for Gases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Draw a vertical line through c upward and obtain the flow rate, or the model and bore.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS71



* Detection of Pressure
Detect the secondary pressure and the loading pressure at the respective detection holes as shown in the construction drawing, by means of union joints and guiding tubes.
(See Fig. 27.1 on page 27, and page 41.)
* Each construction drawing shows the standard installation position.

Dimensions Table of Models NS71 mm

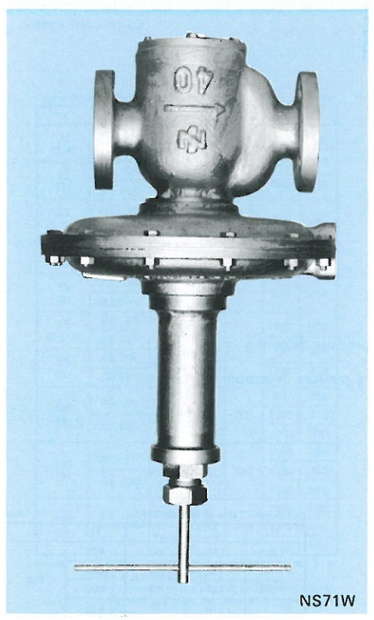
d	L	G	H	ℓ
PT 3/8	135	60	425	150
PT 1/2	135	60	425	
PT 3/4	135	60	425	
PT 1	170	70	435	

· Flange types are also available.
· In the case of flange types, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

- Use this model for differential pressure regulation of various gases including air.
- Specify the set differential pressure (P_2-LP) within the range of from 300 to 0 mmAq.
  (1) P_2 stands for the secondary pressure, and PL for loading pressure.
  (2) Secondary pressure and loading pressure are shown in the specifications column.
  (3) For higher set differential pressures, see pages 32 through 36.
- Obtain the flow rate from the flow rate table.
  For smaller capacities than those, see page 29 (NS71).
- Example of application: Various atmosphere gas generators and combustors.

Specifications \ Model	NS71W
Fluid	Air and various gases
Primary pressure	0.1kgf/cm²g and under
Secondary pressure	0.08 to 0kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	7/1 and under
Min. differential pres. (primary pres.)—(secondary pres.)	0.01kgf/cm²
Rangeability (Cvmax/Cvmin)	7/1 and under
Differential pressure set value (secondary pres.)—(loading pres.)	0.03 to 0kgf/cm²
Main cmponent materials of standard products	Valve body: FC20. Cover: AC2B. Valve plug and seat: SUS or BC. Diaphragm: Rubber

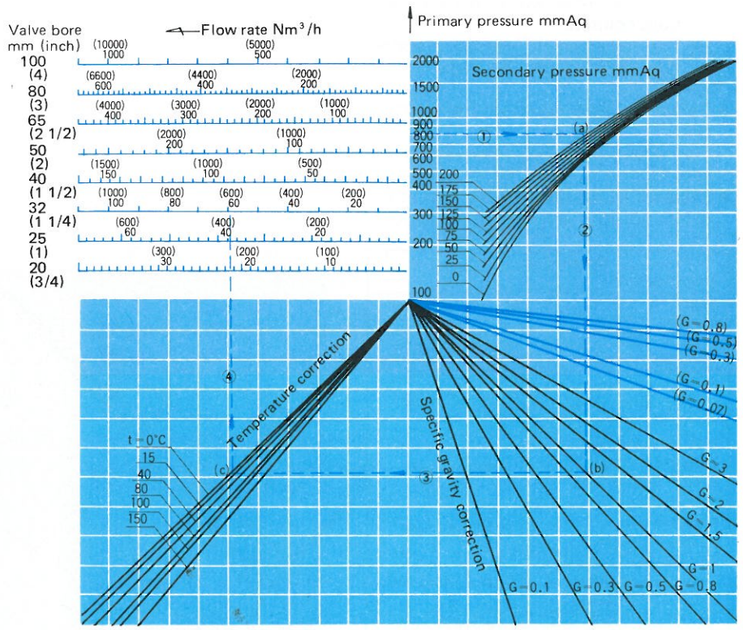
* When special material is to be used, please inform us.


NS71W

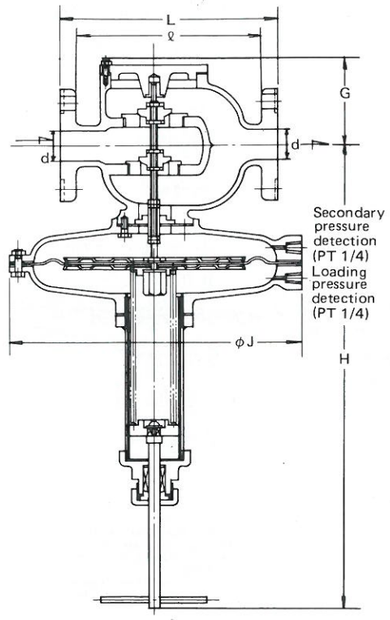
Flow Rate Table for Model NS71W (for Gases)

How to Use the Table
Example: P_1: 800mmAq → P_2: 200mmAq
Specific gravity (G) = 1.
At ordinary temp. (15°C)
When the bore is 32mm, what is the max. flow rate?
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Draw a vertical line from c upward, and obtain the flow rate (59Nm³/h) corresponding to the bore (32mm).

* Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS71W



Dimensions Table of Model NS71W mm

d	Flange	L	ℓ	G	H	J
20 (3/4)	JIS 5K	218	190	85	470	250
	JIS 10K	226				
25 (1)	JIS 5K	218				
	JIS 10K	226				
32 (1 1/4)	JIS 5K	222	190	85	470	300
	JIS 10K	230				
40 (1 1/2)	JIS 5K	222				
	JIS 10K	230				
50 (2)	JIS 5K	222				
	JIS 10K	230				
65 (2 1/2)	JIS 5K	290	254	135	550	360
	JIS 10K	298				
80 (3)	JIS 5K	308	272			
	JIS 10K	316				
100 (4)	JIS 5K	355	315	150	650	410
	JIS 10K	363				

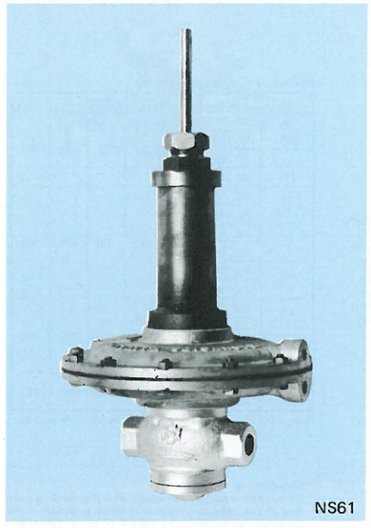
Note: Dimension ℓ indicates dimension between the inner faces.

* Detection of Pressure
Detect the secondary pressure and the loading pressure at the respective detection holes as shown in the construction drawing, by means of union joints and guiding tubes.
(See Fig. 27.1 on page 27, and page 41.)
* The construction drawing shows the standard installation position.
In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

- Use these models for differential pressure regulation of various gases including air.
- Specify the set pressure (P_2-LP) within the range of 0.48 to 0.03 kgf/cm^2.
  (1) P_2 stands for the secondary pressure, and LP for the loading pressure.
  (2) Secondary pressure and loading pressure are shown in the specifications column.
  (3) For higher set differential pressures than these ranges, see pages 33 and 36.
- Obtain the flow rate from the flow rate table.
  For larger capacities than those, see page 32.
- Example of application: Various atmosphere gas generators and combustors.

Specifications \ Model	NS61
Fluid	Air, various gases
Primary pressure	2kg/cm^{2}g and under
Secondary pressure	0.5 to 0.02kgf/cm^{2}g
Standard pressure ratio (primary pres./ secondary pres.)	10/1 and under
Min. differential pressure (primary pres.)—(secondary pres.)	0.01kgf/cm^2
Rangeability (Cvmax/Cvmin)	10/1 and under
Differential pressure set value (secondary pre.)—(loading pres.)	0.48 to 0.03kg/cm^2
Main component materials of standard products	Valve body: FC20. Cover: AC2B. Valve plug and seat: SUS or BC. Diaphragm: Rubber

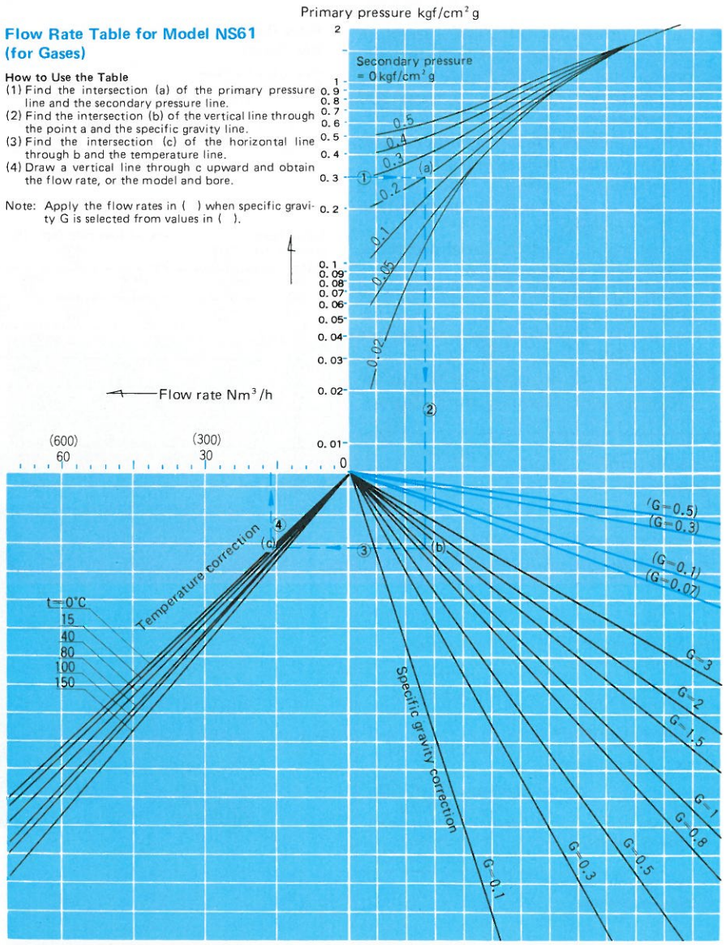
* When special material is to be used, please inform us.



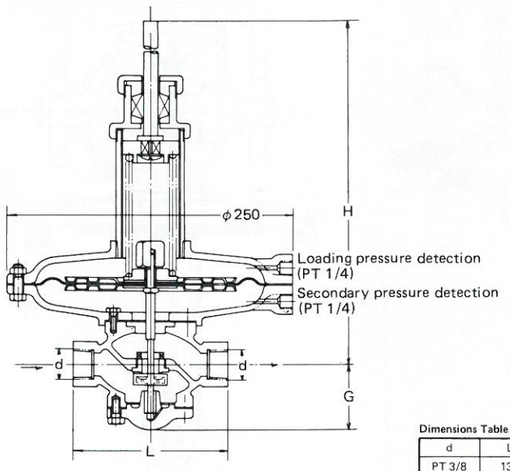
Flow Rate Table for Model NS61 (for Gases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Draw a vertical line through c upward and obtain the flow rate, or the model and bore.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Construction Drawing of Model NS61



* Detection of Pressure
Detect the secondary pressure and the loading pressure at the respective detection holes as shown in the construction drawing, by means of union joints and guiding tubes.
(See Fig. 27.1 on page 27, and page 41.)
* Each construction drawing shows the standard installation position.

Dimensions Table of Models NS61 mm

d	L	G	H	ℓ
PT 3/8	135	60	425	150
PT 1/2	135	60	425	
PT 3/4	135	60	425	
PT 1	170	70	435	

· Flange types are also available.
· In the case of flange types, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

- Use this model for differential pressure regulation of various gases including air.
- Specify the set differential pressure (P_2-LP) within the range of from 0.48 to 0.03 kgf/cm^2.
  (1) P_2 stands for the secondary pressure, and LP for the loading pressure.
  (2) Secondary pressure and loading pressure are shown in the specifications column.
  (3) For higher set differential pressures than this range, see pages 33 and 35. And for lower ones, see page 29 and 30.
- Obtain the flow rate from the flow rate table.
  For smaller capacities than those, see page 31 (NS61).
- Example of application: Various atmosphere gas generators and combustors.

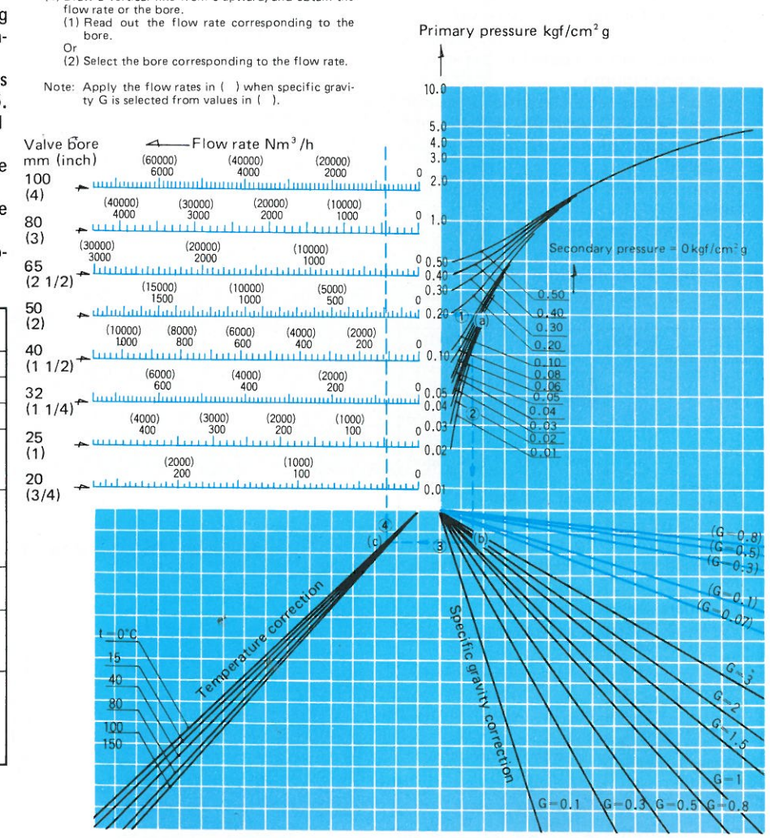
Specifications \ Model	NS51
Fluid	Air and various gases
Primary pressure	5kgf/cm^{2}g and under
Secondary pressure	0.5 to 0.02kgf/cm^{2}g
Standard pressure ratio (primary pres./ secondary pres.)	10/1 and under
Min. differential pressure (primary pres.)—(secondary pres.)	0.1 (secondary pres. + 0.1) kgf/cm^2
Rangeability (Cvmax/Cvmin)	10/1 and under
Differential pressure set value (secondary pres.)—(loading pres.)	0.48 to 0.03kgf/cm^2
Main component materials of standard products	Valve body: FC20. Cover: AC2B. Valve plug and seat: SUS or BC. Diaphragm: Rubber

* When special material is to be used, please inform us.

Flow Rate Table for Model NS51 (for Gases)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through the point b and the temperature line.
(4) Draw a vertical line from c upward, and obtain the flow rate or the bore.
(1) Read out the flow rate corresponding to the bore.
Or
(2) Select the bore corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).

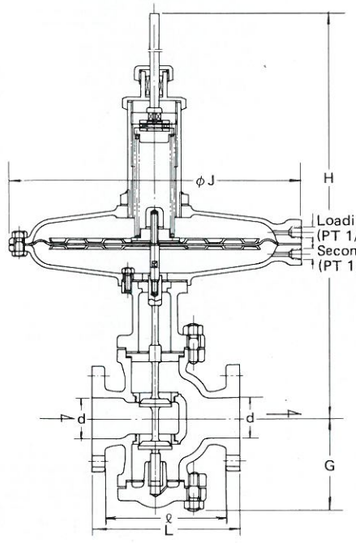


Dimensions Table of Model NS51 mm

d	Flange	L	ℓ	G	H	J
20 (3/4)	JIS 5K	202	174	90	495	250
	JIS 10K	210			515	300
25 (1)	JIS 5K	202			545	410
	JIS 10K	210				
32 (1 1/4)	JIS 5K	181	149	115	620	250
	JIS 10K	189				
40 (1 1/2)	JIS 5K	181			635	300
	JIS 10K	189				
50 (2)	JIS 5K	181			670	410
	JIS 10K	189				
65 (2 1/2)	JIS 5K	250	214	135	725	250
	JIS 10K	258			750	300
80 (3)	JIS 5K	250			790	410
	JIS 10K	258				
100 (4)	JIS 5K	328	288	205	950	360
	JIS 10K	336			1000	410
					1050	550
125 (5)	JIS 5K	427	387	240	1170	360
	JIS 10K	435			1250	410
					1230	550
150 (6)	JIS 5K	497	453	280	1230	360
	JIS 10K	505			1270	410
					1300	550

Notes: · Dimension H corresponds to dimension J as shown in the table above.
· Classify dimension J according to the table below.
· Dimension ℓ indicates the dimension between the inner faces.
· In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Construction Drawing of Model NS51



Diaphragm Diameter (J) mm

Bore (d)		(secondary pressure) − (loading pres.) kgf/cm^{2}g (set pressure)
80mm and under	100mm and over	
250	360	0.1 and over, and 0.5 and under
300	410	0.03 and over, and less than 0.1
410	550	0.01 and over, and less than 0.03

* Detection of Pressure
Detect the secondary pressure and the loading pressure at the respective detection holes as shown in the construction drawing, by means of union joints and guiding tubes.
(See Fig. 27.1 on page 27, and page 41.)
* The construction drawing shows the standard installation position.

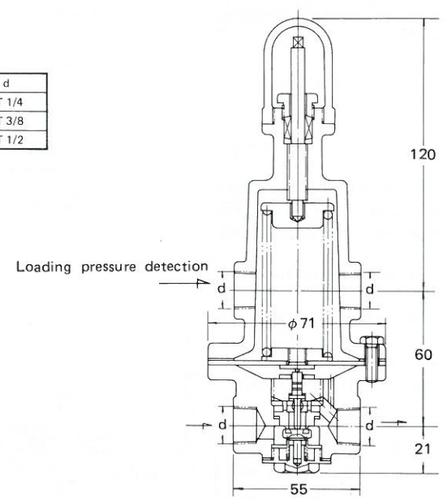
- Use these models for differential pressure regulation of gases and liquids, such as oil and air, and gas and air.
- Specify the set differential pressure (P_2-LP) within the range of from 4 to 0.5kgf/cm^2.
  (1) P_2 stands for the secondary pressure, and LP for the loading pressure.
  (2) Secondary pressure and loading pressure are indicated in the specifications column.
  (3) For higher set differential pressures, see page 35. And for lower ones, see pages 29 through 32 (for gases only).
- Obtain the flow rate from the flow rate table.
  For larger capacities than those, see page 35.
- Example of application: Various atmosphere gas generators and combustors.

Specifications \ Model	NS40	NS80 NS80W
Fluid	Air, various gases, water and oil	Air, various gases, water, oil and steam
Primary pressure	7kgf/cm^{2}g and under	16kgf/cm^{2}g and under
Secondary pressure	4 to 0.5kgf/cm^{2}g	
Standard pressure ratio (primary pres./secondary pres.)	7/1 and under	10/1 and under
Min. differential pressure (primary pres.)—(secondary pres.)	0.5kgf/cm^2	
Rangeability (Cvmax/Cvmin)	10/1	
Differential pres. set value (secondary pres.)—(loading pres.)	4 to 0.5kgf/cm^2	
Main component materials of standard products	Valve body: BC6. Cover: BC. Valve plug and seat: C3604	Valve body: FC20. Cover: FC20. Valve plug and seat: SUS

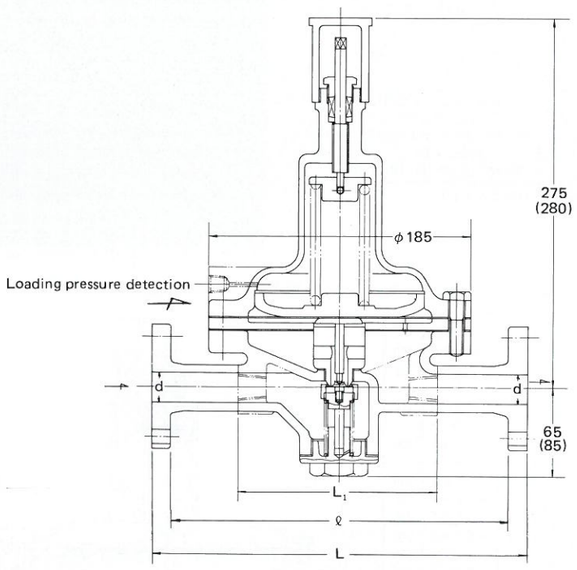
* When special material is to be used, please inform us.

Construction Drawing of Model NS40

d
PT 1/4
PT 3/8
PT 1/2



Construction Drawing of Model NS80



Dimension in ( ) indicates that of Model NS80W.
Note: The inner valve construction of Model NS80W is the same with NS75W (page 21).

* Detection of Pressure
Detect the loading pressure at the detection hole as shown in the construction drawing, by means of a union joint and a guiding tube.
(See Fig. 27.1 on page 27, and page 41.)
* Each construction drawing shows the standard installation position.

Face-to-Face Dimension Table of Model NS80 mm

d	Flange	L	ℓ	Threaded	L_1
15 (1/2)	JIS 5K	258	234	PT 1/2	140
	JIS 10K	266			
	JIS 16K	266			
20 (3/4)	JIS 5K	262		PT 3/4	
	JIS 10K	270			
	JIS 16K	270			
25 (1)	JIS 5K	262		PT 1	
	JIS 10K	270			
	JIS 16K	270			

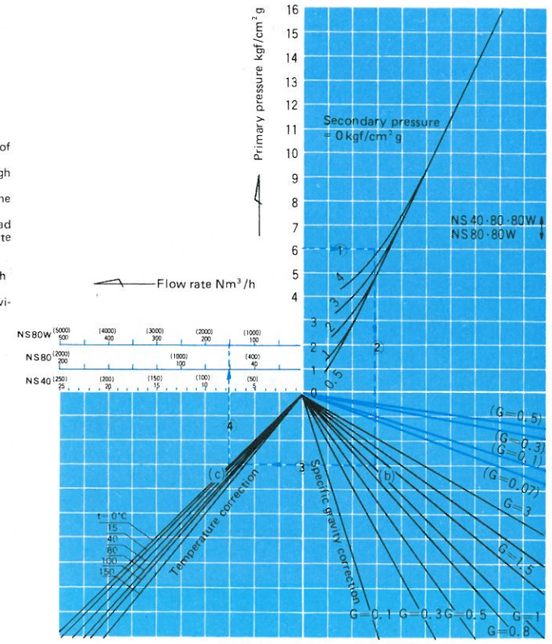
* In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Flow Rate Table for Models NS40, NS80 and NS80W (for Gases)

How to Use the Table (Method of Model Selection)
Example: Specifications
P_1 : 6k → P_2 : 4k
Q : Air, 40Nm^3/h. Specific gravity G=1 at ordinary temperature.

Procedure
(1) Find the intersection (a) of the pressure line of P_1=6k and the pressure line of P_2=4k.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Find the intersection (c) of the horizontal line through b and the temperature line.
(4) Next, draw a vertical line from c upward, and read out the required flow rate or the nearest flow rate to it.
→ Determination of Model
Model NS80 Max. possible flow rate: 60Nm^3/h

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).

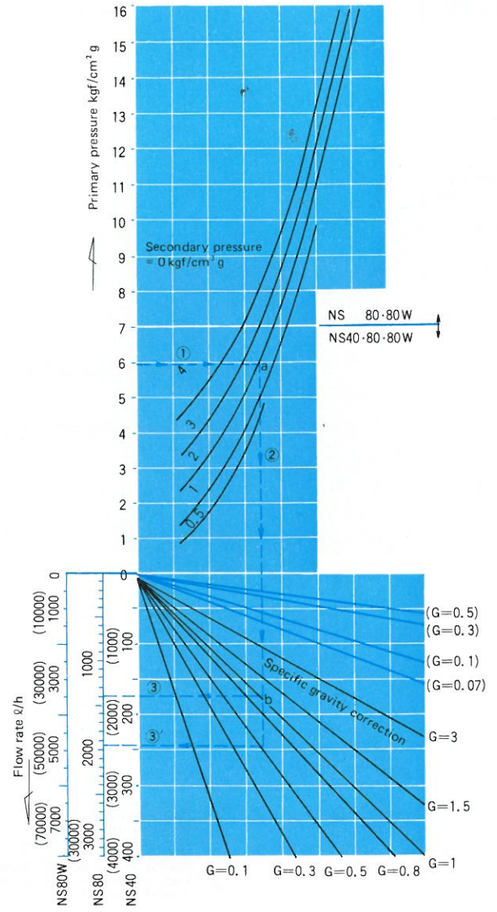


Flow Rate Table for Models NS40, NS80 and NS80W (for Liquids)

How to Use the Table
Example: Speciications
P_1 : 6k → P_2 : 2k
Q : Water, 1,200ℓ/h. Specific gravity G=1

Procedure
(1) Find the intersection (a) of the pressure line of P_1=6k and the pressure line of P_2=2k.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Draw a horizontal line from b to the left, and read out the required flow rate, or the nearest flow rate to it.
→ Model Determination
Model NS80 Max. possible flow rate: 1,370ℓ/h
When G=0.5 as is the case of 3′, the max. flow rate is 1,930ℓ/h.)

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



- Use these models for differential pressure adjustment of gases, liquids and steam.
- Specify the set differential pressure (P_2-LP) within the range of from 7 to 0.5kgf/cm².
  (1) P_2 stands for the secondary pressure, and LP stands for the loading pressure.
  (2) Secondary pressure and loading pressure are indicated in the specifications column.
  (3) For lower set differential pressures, see pages 29 through 34.
- Obtain the flow rate from the flow rate table.
- Example of application: Oil combustors. Differential pressure regulation for gas combustors. Differential pressure regulation for atmosphere gas generators.

Specifications \ Model	NS90-1/NS90-2
Fluid	Air, various gases, water, oil and steam
Primary pressure	16kgf/cm²g and under
Secondary pressure	10 to 0.5kgf/cm²g
Standard pressure ratio (primary pres./ secondary pres.)	7/1
Min. differential pres. (primary pres.)—(secondary pres.)	0.1 (secondary pres. + 5) kgf/cm²
Rangeability (Cvmax/Cvmin)	10/1 and under
Differential pressure set value (secondary pres.)—(loading pres.)	7 to 0.5kg/cm²
Main component materials of standard prodcts	Valve body: FC20. Valve plug and seat: SUS. Bellows: C5191 (fluid temp. 175°C and under), SUS (fluid temp. 220°C and under)

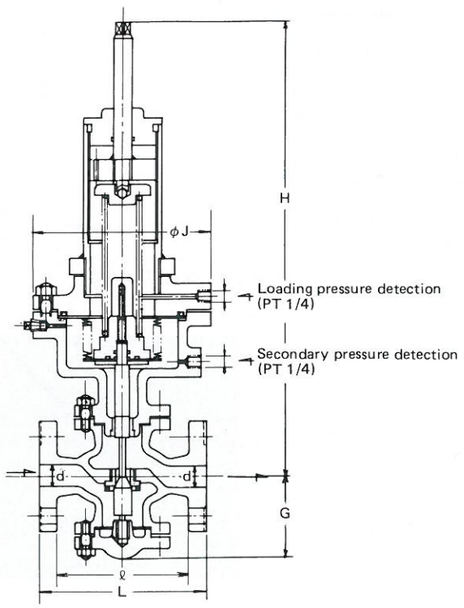
* When special material is to be used, please inform us.

Dimensions Table of Models NS90-1 and NS90-2 mm

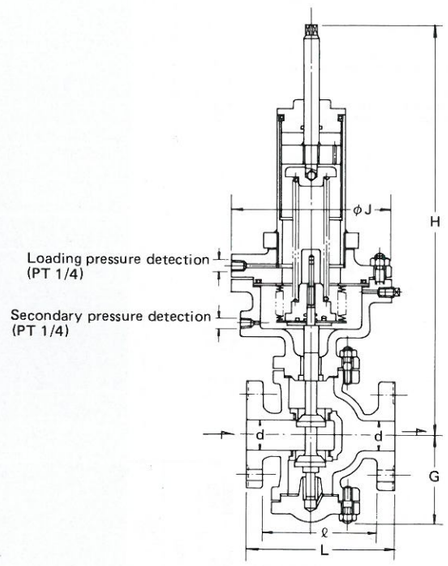
d	Flange	L	ℓ	G	H	J
20 (3/4)	JIS 5K	202(180)	174 (152)	100 (95)	610	205
	JIS 10K	210 (188)				
	JIS 16K					
25 (1)	JIS 5K	202(180)				
	JIS 10K	210 (188)				
	JIS 16K					
32 (1 1/4)	JIS 5K	181	149	120	735	
	JIS 10K	189				
	JIS 16K	189				
40 (1 1/2)	JIS 5K	181				
	JIS 10K	189				
	JIS 16K	189				
50 (2)	JIS 5K	181				
	JIS 10K	189				
	JIS 16K	199	159			
65 (2 1/2)	JIS 5K	250	214	140	810	
	JIS 10K	258				
	JIS 16K	258				
80 (3)	JIS 5K	250				
	JIS 10K	258				
	JIS 16K	262				
100 (4)	JIS 5K	370	–	210	935	215
	JIS 10K					
	JIS 16K					
125 (5)	JIS 5K	425	–	255	1050	215
	JIS 10K					
	JIS 16K					
150 (6)	JIS 5K	475	–	290	1400	
	JIS 10K					
	JIS 16K					

Note: · Dimension in ( ) indicates that of Model NS90-1.
· Dimension ℓ indicates dimension between the inner faces.
· In the case of ANSI flanges, dimension L can be obtained by adding twofold flange thickness to dimension ℓ shown above.

Construction Drawing of Model NS90-1



Construction Drawing of Model NS90-2

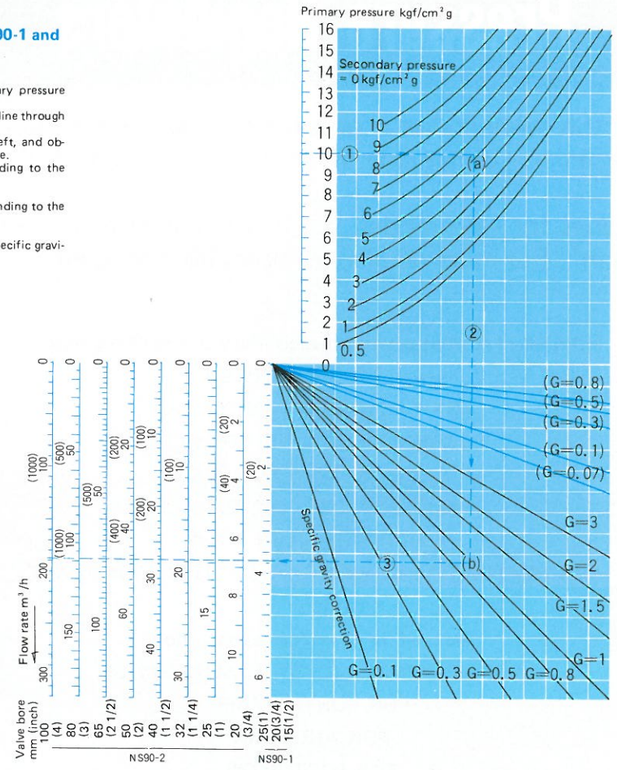


* Detection of Pressure
Detect the secondary pressure and the loading pressure at the respective detection holes as shown in the construction drawing, by means of union joints and guiding tubes.
(See Fig. 27.1 on page 27, and page 41.)
* Each construction drawing shows the standard installation position.

Flow Rate Table for Models NS90-1 and NS90-2 (for Liquids)

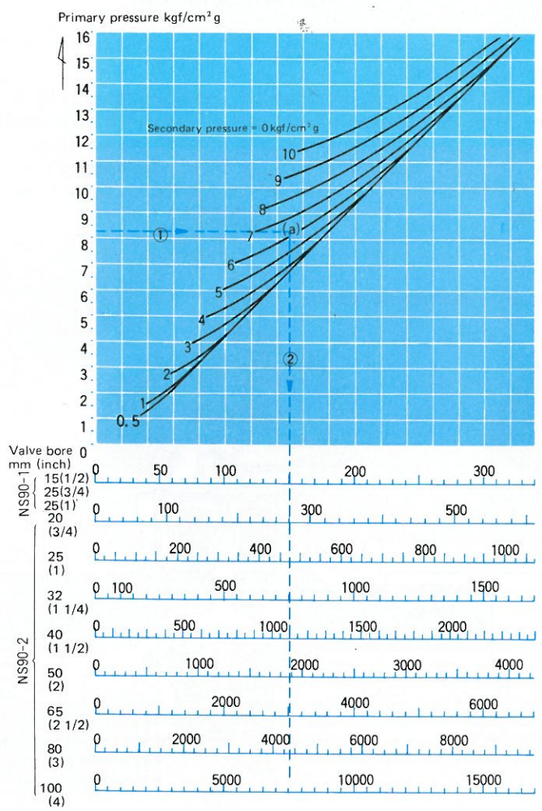
How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Find the intersection (b) of the vertical line through the point a and the specific gravity line.
(3) Draw a horizontal line from b to the left, and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.

Note: Apply the flow rates in ( ) when specific gravity G is selected from values in ( ).



Flow Rate Table for Models of NS90-1 and NS90-2 (for Steam)

How to Use the Table
(1) Find the intersection (a) of the primary pressure line and the secondary pressure line.
(2) Draw a vertical line through the point a downward and obtain the flow rate, or the model and bore.
  (1) Read out the flow rate corresponding to the model and bore.
  Or
  (2) Select the model and bore corresponding to the flow rate.



Flow Rate Table for Models NS90-1 and NS90-2 (for Gases)

For flow rates of these models for gases, see the flow rate table on page 23: for Model NS90-1, see Model NS93-1. For Model NS90-2, see Model NS93-2.

Pilot Operated Type Secondary Pressure Regulators

Installation of this valve makes it possible to regulate the fluid pressure at a constant value on the outlet side of the valve, irrespective of fluctuation in load.
Set pressure varies for each model, but it is designed within a range of from 22 to 0.5 kgf/cm^2. For more details, see pages 38 throug 40.

NAKAKITA pilot operated secondary pressure regulators
are used for steam application
FOR GENERAL STEAM SERVICE
FOR BOILER BURNER ATOMIZING
FOR HEATING SERVICE
FOR ACCOMODATION SERVICE
FOR AUX. BOILER ASSIST
FOR HEATING STEAM PIPING OF DESALINATION PLANT.
etc.
are used for air and gases application
FOR GENERAL AIR AND GASES SERVICE
FOR CONTROL AIR
FOR AIR HORN
FOR SOOT BLOW
FOR HOT SCARFER
etc.

Outline of Operation

As shown in the figure below, the secondary pressure is detected by the diaphragm of the pilot valve. When the detected value shows a deviation from a specified set value, the valve will make a corrective action in proportion to the deviation to open or close the pilot valve. The pilot valve in turn controls the control pressure upon the upper side of the piston to open or close the main valve in order to maintain the secondary pressure at the set value.

*This piping construction drawing indicates Model NS500SI.

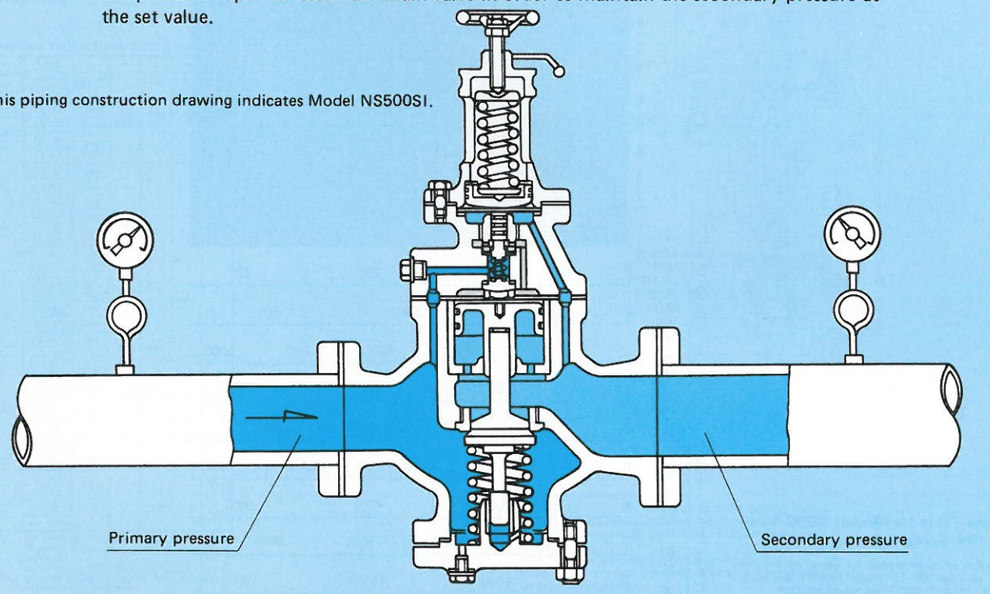


Fig. 37.1

1. Construction Drawings

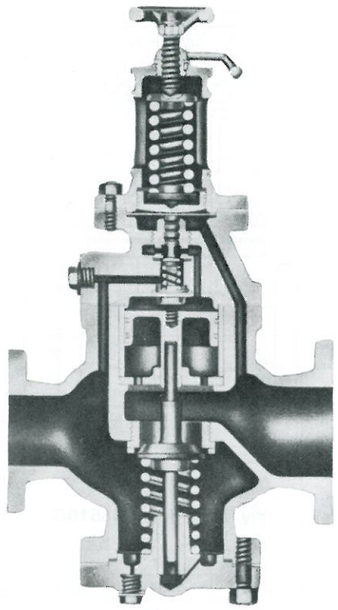


Fig. 38-1

(Indicates Models NS500SI and NS500SM.)
(Model NS500SE has the same construction with that shown in the drawing, except it is a secondary pressure external detection type.)

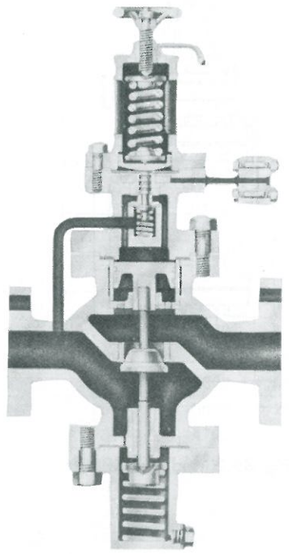


Fig. 38-2

(Indicates Model NS500SH.)

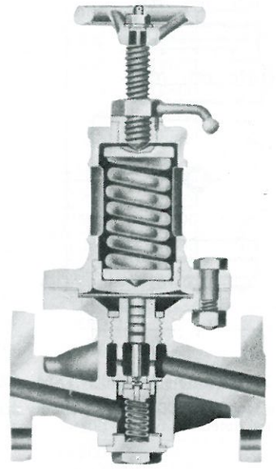


Fig. 38-3

(Indicates Model NS510G.)
(Direct acting type)

2. Configuration of Valve Plugs

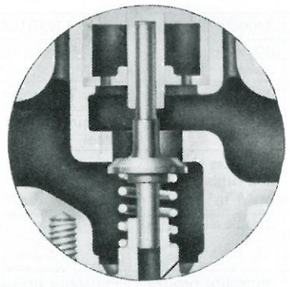


Fig. 38-4 (Single Seat)

(This figure shows the plug configuration for Models NS500SI, NS500SM, NS500SE and NS500SH with a bore in the range of from 15mm (1/2 inch) to 150mm (6 inches).)

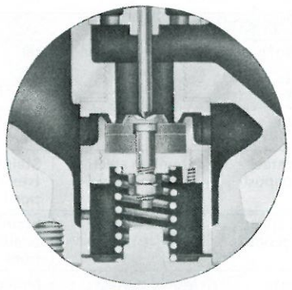


Fig. 38-5 (Flexible Disk)

(This figure shows the plug configuration for Model NS500GI.)
(The construction is the same that of Model NS500SI of Fig. 38-1, except the valve plug configuration.)

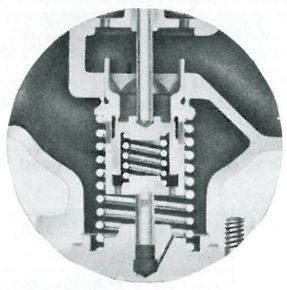


Fig. 38-6 (Double Seat)

(This figure shows the plug configuration for Model NS500SI with a bore of 200mm (8 inches).)

3. Overall Size

The overall size of each model of Secondary Pressure Regulator is as shown below.

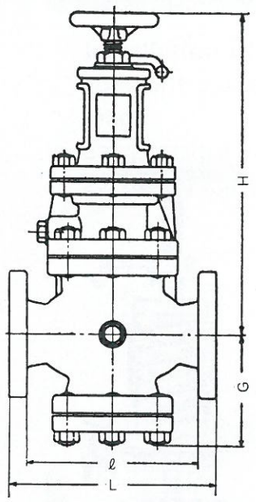


Fig. 39.1 Models NS500SI, -SM, -SE and -GI

(Note Model NS500SE is a secondary pressure external detection type.)

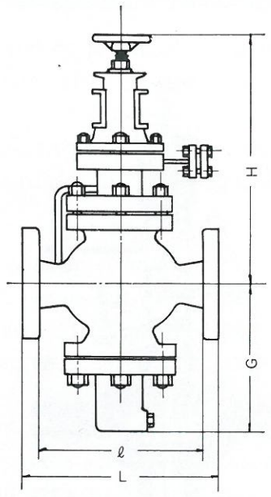


Fig. 39.2 Model NS500SH

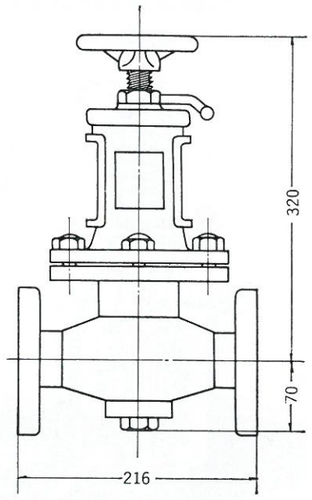


Fig. 39.3 Model NS510G

Table 1 Table of Overall Size

Model	Valve bore mm (inch)	15 (1/2)	20 (3/4)	25 (1)	40 (1-1/2)	50 (2)	65 (2-1/2)	80 (3)	100 (4)	125 (5)	150 (6)	200 (8)
NS 500 SI	H	320			370	370	460	460	500	500	600	700
	ℓ	176			180	200	270	270	354	354	446	540
	G	120			125	150	164	164	200	205	245	315
NS 500 SM SE	H	410			450	450	550	550	600	700	–	–
	ℓ	216			228	254	334	334	350	390	–	–
	G	150			162	160	225	225	250	280	–	–
NS 500 SH	H	410			450	450	550	550	600	700	–	–
	ℓ	216			231	248	334	334	350	388	–	–
	G	220			225	230	380	380	425	460	–	–
NS 500 GI	H	320			370	370	–	–	–	–	–	–
	ℓ	146			180	200	–	–	–	–	–	–
	G	75			105	125	–	–	–	–	–	–

(Note) Dimension "L" can be obtained by adding twofold flange thickness to dimension "ℓ" shown above.

Table 2 Table of Materials of Main Components

Model	Models NS500SI, -SM, -SE and -SH				Model NS500GI	Model NS510G
Pressure / Temperature / Component	16 kgf/cm² g and under	20 kgf/cm² g and under	60 kgf/cm² g and under		30 kgf/cm² g and under	30 kgf/cm² g and under
	220° C and under	300° C and under	400° C and under	450° C and under	80° C and under	80° C and under
Valve body,	Cast iron	Cast steel	Cast steel	Molybdenum cast steel	Cast iron or cast steel	Forging or cast steel
Main valve	Stainless steel	Stainless steel (stellite deposition)	Stainless steel (stellite deposition)	Stainless steel (stellite deposition)	Stainless steel and rubber	Stainless steel and rubber
Pilot valve and valve seat	Stainless steel	Stainless steel (stellite deposition)	Stainless steel (stellite deposition)	Stainless steel (stellite deposition)	Stainless steel	–
Diaphragm	Phosphor bronze	Monel metal	Monel metal	Monel metal	Phosphor bronze	Phosphor bronze
Piston and cylinder	Stainless steel	Stainless steel (surface hardened)	Stainless steel (surface hardened)	Stainless steel (surface hardened)	Stainless steel	–
Spring for pilot valve	Chrome-vanadium steel	Stainless steel	Special heat resisting steel	Special heat resisting steel	Phosphor bronze	–
Spring for main valve	Spring steel	Chrome-vanadium steel	Special heat resisting steel	Special heat resisting steel	Stainless steel	Phosphor bronze
Pressure adjusting spring	Spring steel	Spring steel	Spring steel	Spring steel	Spring steel	Spring steel

4. Flow Rate Tables

Table 3 Saturated Steam Flow Rate Table for Models NS500SI, -SM, -SE and -SH (kg/h)

Pressure (kgf/cm² g)		Bore mm (inch)									
Primary	Secondary	15 (1/2)	20 (3/4)	25 (1)	40 (1-1/2)	50 (2)	80 (3)	100 (4)	125 (5)	150 (6)	200 (8)
3	0.5	70	130	170	300	465	1200	2700	3000	4200	13500
	1	70	220	300	930	1000	3700	6100	7100	11000	13500
6	1	130	220	300	530	810	2100	4800	5300	7400	23500
	2	130	400	530	1600	1800	6500	10500	12500	19500	23500
	4	100	320	420	1300	1500	5200	8700	10000	15500	19000
10	2	200	360	470	830	1200	3300	7500	8300	11000	37000
	4	200	630	830	2500	2900	10000	16500	19500	30500	37000
	8	130	410	550	1700	1900	6800	11000	13000	20000	24500
20	4	390	680	900	1500	2400	6300	14000	15500	22000	71000
	7	390	1200	1500	4900	5600	19500	32000	37500	58500	71000
	16	260	810	1000	3300	3800	13000	21500	25000	39500	48000
30	5	580	1000	1300	2300	3600	9400	21000	23500	–	–
	10	580	1700	2300	7200	8300	29000	47500	55000	–	–
	22	440	1300	1800	5600	6400	22000	37000	42500	–	–
40	7	760	1300	1700	3100	4700	12000	28000	31000	–	–
	14	760	2300	3100	9500	11000	38000	63000	73000	–	–
	22	730	2200	2900	9100	10500	36500	60000	70000	–	–
50	10	950	1600	2200	3800	5900	15500	35000	38500	–	–
	15	950	2900	3800	11500	13500	47500	78500	91000	–	–
	22	950	2900	3800	11500	13500	47500	78500	91000	–	–

Table 4 Air Flow Rate Table for Model NS500GI (Nm³/h)

Pressure (kgf/cm² g)		Valve bore mm (inch)				
Primary	Secondary	15 (1/2)	20 (3/4)	25 (1)	40 (1-1/2)	50 (2)
3	0.5	45	80	115	210	330
	1	45	125	170	330	660
6	1	70	125	170	315	495
	2	80	220	295	580	1160
	4	65	180	240	465	935
10	2	125	275	320	575	1290
	4	125	350	470	910	1820
	8	85	230	310	605	1210
20	4	245	435	605	1100	1740
	7	245	665	895	1735	3480
	16	165	450	610	1180	2360
30	5	360	640	895	1625	2570
	10	360	980	1320	2565	5130
	22	280	760	1030	1990	3980

In the case of steam, the values of the table are for saturated steam. In the case of superheated steam, multiply the following coefficients according to the degree of superheat.

Correction Coefficient

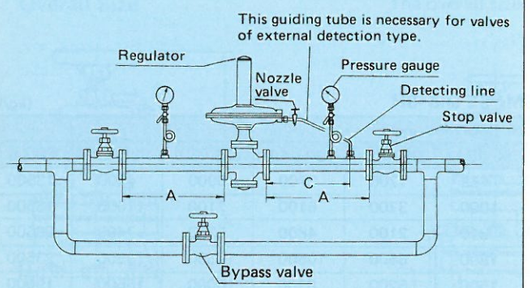
Degree of superheat	Coefficient	Degree of superheat	Coefficient
10° C	0.987	95° C	0.89
40° C	0.95	150° C	0.836
65° C	0.922		

Table 5 Flow Rate Table for Model NS510G

Pressure kgf/cm² g / Valve bore mm (inch) / Fluid		Air Nm³/h			Water ℓ/h			Saturated steam kg/h		
Primary	Secondary	15 (1/2)	20 (3/4)	25 (1)	15 (1/2)	20 (3/4)	25 (1)	15 (1/2)	20 (3/4)	25 (1)
20	0 ~ 10	35	40	80	400	440	810	25	30	70
	13	35	35	75	340	370	675	25	40	60
	16	30	35	55	280	310	510	20	30	50
25	0 ~ 13	45	50	105	440	480	885	35	55	85
	16	40	45	90	360	400	765	30	35	80
30	0 ~ 16	50	60	120	480	520	950	40	50	105

When Making an Installation Plan of a Regulator

Schematic diagram of the instrumentation



1 Provide a sufficient space above and below the regulator for ease in disassembly and repair. The valve is normally installed upright relative to the horizontal piping system. When specially specified, it is installed upside down.
(Models NS70, NS70W, NS71 and NS71W are installed upside down.)

2 Provide the regulator piping system with a bypass valve, whenever possible, for ease in maintenance and repair. Also install the following accessories to protect the regulator.
[Strainer, stop valve, and pressure gauge]

3 Plan the straight pipe dimension A on both inlet and outlet sides of the regulator so that it meets the following condition:
$A \geq 10\ d$ (where d : valve bore in mm)

4 For valves of external detection type, detect the pressure by connecting the pressure regulated piping and the detection hole in the valve with a guiding tube. [PT1/4 union joints, a guiding tube, and a throttle valve] Plan the detection position C to satisfy the following condition:
$C = 5d$ to $10d$ (where d : bore in mm)

5 Valves of construction wherein flexible disk is not used show a minute amount of leak, especially in the case of double seat valves. Pay due attention to the maintenance of these devices.

When Placing an Order for or Making and Enquiry about a Regulator

When placing an order for or making and enquiry about a regulator, please specify the following items:

1 Valve bore (or pipe diameter being planned)

2 Kind of fluid (specific gravity and vicosity)

3 Primary side pressure (maximum and minimum)

4 Secondary side pressure (maximum and minimum)

5 Flow rate (maximum and minimum)

6 Temperature (maximum and minimum)

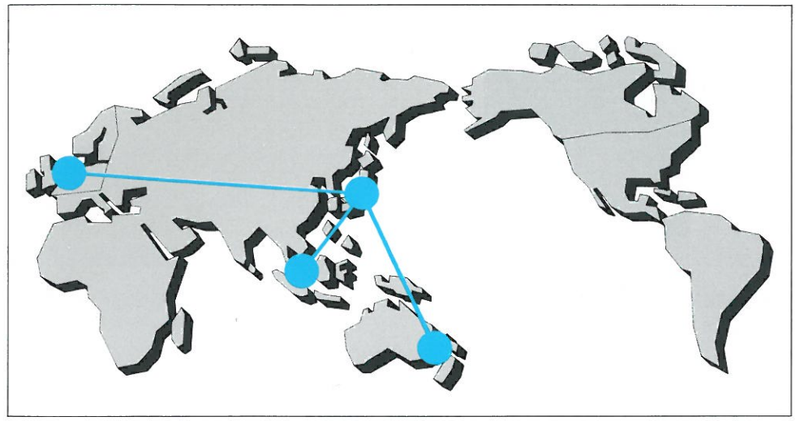
7 Flange standard (connection)

8 Presence of accessories (such as strainer, pressure gauge, joint, etc.)

9 Other special requirements (dimensions, materials, etc.)

Note: For determining the valve bore of each model and planning the approximate flow rate, see the flow rate tables.

ESTABLISHED AFTER SALES SERVICE NETWORK TO ALL OVER THE WORLD



We have set up a perfect after-service network as listed below in order to cover the world-wide requirements and to provide the quick and proper technical service.

DOMESTIC SERVICE NETWORK

SERVICE STATION	No. FOR ENGINEERS	TERRITORY
Main station. Head Office, Osaka	20 Engineers and 25 assistants.	Middle and Western Japan, Shikoku area and Hokkaido districts.
Tokyo station. Tokyo Office.	8 Engineers and 19 assistants.	Eastern and Northern Japan, Central Japan.
Kyushu station. Kitakyushu Office	3 Engineers and 11 assitants	Kyushu and Shikoku area, Western Japan.

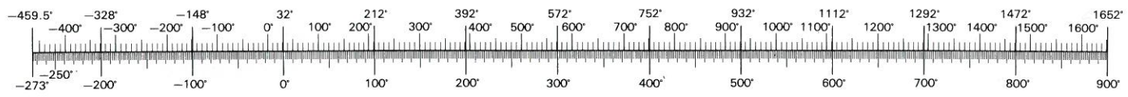
OVERSEAS SERVICE NETWORK

SERVICE AGENT	TERRITORY
MANOTHERM B.V. WELPLAATHOEK 20, BOTLEK, ROTTERDAM, NETHERLAND TELEX: 28604 TERMO NL CABLE: THERMO ROTTERDAM TEL: 10-4169011 FAX: 10-4169695	EUROPE
YOKOSIN MARINE CO., (PTE) LTD. 18, KIM CHUAN TERRACE SINGAPORE 1953 TEL: 2863588 (4 LINES) FAX: 2808959 TELEX: RS 37217 YOKMAR	SINGAPORE MALAYSIA and INDONESIA
HONEYWELL LIMITED AUSTRALIA 863 BOURKE STREET, WATERLOO NSW2017 AUSTRALIA TEL: 2-699-0155 FAX: 2-690-9416 TELEX: AA20614 HONEYWL	AUSTRALIA

COMPARISONS OF UNITS

■ TEMPERATURE

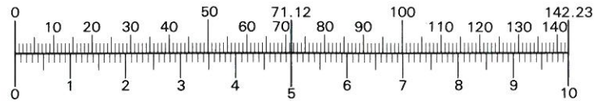
FAHRENHEIT °F $\quad °F = °C \times \frac{9}{5} + 32$



CENTIGRADE °C

■ PRESSURE

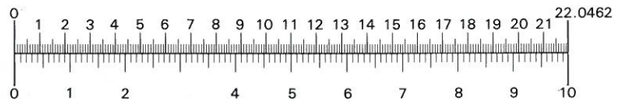
PSI



kgf/cm²

■ WEIGHT

POUNDS lb



KILOGRAMS kg